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FLIES AND INFECTIOUS DISEASE.[1]

BY LAUNCELOT HARRISON, B.A., B.Sc.,
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WHEN your Secretary asked me last March to address you in September upon the subject of "Flies and Infectious Disease," it was quite an easy matter to say "Yes!" As, however, September drew nigh, I have grown more and more uneasy at the prospect of talking about disease to a medical audience which will know so much more about it than I do myself. Since, moreover, those of you who are interested in diseases which are transmitted by insects, may be expected to know all about the insects as well, my opportunity for saying anything which is either novel or interesting, is not very great.

Casting round for a reason as to why I had been approached at all, I concluded that it was because of my association with the Mesopotamian Expeditionary Force as Advisory Entomologist and that some account of the work in which I participated there, would probably be of more interest to you than anything else which I might have to say. Before proceeding to this account, however, I have thought it well to traverse briefly the history of the connexion of flies with disease and to illustrate by means of lantern slides some of the more important of these insects and a few features of interest in their structure, life histories and habits.

[1] Read at a meeting of the New South Wales Branch of the British Medical Association on September 29, 1922.

Insects as Vectors of Disease.

The association of minute parasitic organisms with the diseases to which they give rise is of comparatively recent date. Larval *filariæ* were first discovered by Demarquay in 1863 in the peripheral blood of man. Thirteen years later, Bancroft, domiciled in Australia, discovered the adults in the deeper lymphatics; but it was not until considerably later that the disease elephantiasis was definitely shown to be due to hypertrophy of lymphoid tissues consequent upon long-standing presence of the parasite. The discovery of the spirochæte of relapsing fever was due to Obermeier, in 1873; of the *entamœba* of dysentery to Lösch, in 1875; of the malaria parasite to the French army surgeon, Laveran, who died a few months ago, in 1880; of the trypanosome of sleeping sickness to the work of Forde and Dutton in 1901; of the parasites which cause oriental sore and kala azar, to that of Leishmann and Donovan in 1903.

The connexion of insects with these parasitic diseases and the elucidation of their rôle as vectors is of still more recent date. It is true that Sir

Patrick Manson, that great pioneer in the field of tropical disease, who also died during the present year, suggested as long ago as 1879 that microfilariæ might be transmitted by blood-sucking insects, such as mosquitoes. But the matter was not proved at that date. Bruce, in 1893, elucidated the part played by tsetse flies in the transmission of sleeping sickness. The extraordinary complex life cycle of the plasmodium of malaria was first worked out by Sir Ronald Ross in 1898. In 1900 the American Yellow Fever Commission first demonstrated the relation between yellow fever and *Stegomyia*—or, as we must now say, *Aëdes calopus*. Proof that culicine mosquitoes are vectors of dengue is due to Graham, 1902. Lice were incriminated as carriers of typhus infection simultaneously by Nicolle in Algeria and Ricketts in Mexico in 1909. Curiously enough, although the house fly has long been suspected of acting as a carrying agent for various diseases, its actual guilt has only been proven during the last decade.

Graham Smith, in his capacity as Lecturer in Hygiene at Cambridge, did a very considerable amount of careful research on the common domestic flies, which was planned on broad lines and carefully controlled. Having regard to its great importance and value, this work hardly seems to have received the recognition to which it is entitled. He began to publish in 1911 and his work is confirmed by that of Howard in America in work dating from about the same time. Graham Smith traced the parallel incidence of flies and summer diarrhœa and, by means of cultures from the external surface and various parts of the alimentary canal of house flies, showed conclusively that certain diseases, such as anthrax, diphtheria and tuberculosis, might occasionally be transmitted by flies and that enteric fever was almost certainly often so transmitted.

Wenyon and O'Connor, working in Egypt in 1915, showed convincingly that flies were able to pass through their enteric canal not only bacteria, but the cysts of certain pathogenic protozoa, such as entamœba, giardia, etc., and the smaller helminth eggs, such as those of tape-worms and a few nematodes.

I have no figures available as to the total annual loss due to insect-carried disease throughout the world, but a few casual examples will serve to show that this loss is enormous. Ross, who makes the interesting suggestion that the downfall of the great Greek civilization was probably due to malaria, quotes upwards of one million deaths annually from this cause in India alone. We know that the mortality from plague, transmitted by rat fleas, is considerably higher. Howard states that there are twelve thousand deaths from malaria each year in the United States and estimates the annual economic loss due to this disease at twenty millions sterling. More recently we have been given enormous figures for the deaths due to typhus in eastern and central Europe.

There is no need to labour the point that insects, particularly those whose bodies harbour stages in the life cycle of organisms pathogenic in man, constitute a grave menace, even to modern civilized communities.

Flies and Mosquitoes.

The title of this address, however, limits me to flies, that is to say, to the order *Diptera*, which includes those insects which have wings upon the mesothorax only, the metathoracic pair being reduced to rudimentary *halteres* or balancers. Of the large number of families contained within the order only two are of prime importance from my present point of view, *viz.*, the *Culicidæ*, which includes both anopheline and culicine mosquitoes, and the *Muscidæ*, which includes the tsetse flies, blow flies, house flies and their allies.

A family of blood-sucking flies, the *Tabanidæ*, has been shown to transmit anthrax in China and kala azar in India and, as these flies habitually suck the blood of man, they must be looked upon with suspicion. *Phlebotomus papatasii*, the sand fly of the Mediterranean area and western Asia, which belongs to the family *Psychodidæ*, transmits the unknown causative agent of the well-known "three-day" or sand-fly fever. This fever, which is comparatively mild in itself, lasting only three days and causing a fever up to only 39° C. to 39.5° C., is nevertheless peculiarly debilitating and convalescence is accompanied by acute depression. This last factor made the disease a particular nuisance in Mesopotamia, where in the summer the troops suffered from all the causes for depression that they could tolerate. The biennial dose of sand fly was the last straw. I remember upon one occasion travelling from the Es Sinn position with a battalion of the Devon Regiment which was going back to "rest." This particular battalion had been in occupation of the Dujailah Redoubt, which was out of range of the Turkish guns, and had been engaged in the peaceful task of digging trenches. Yet, owing to the ravages of flies by day and sand flies by night, its efficient personnel was reduced to fifty-one of all ranks. Nor shall I forget in a hurry another experience of my own. On my way to India to convalesce after having successfully survived typhus and malaria, which I, more ambitious than discreet, had succeeded in acquiring simultaneously, I awaited transport in an Officers' Hospital south of Basra, where about two hundred officers were convalescing from sand fly. Not one of these smiled, nor looked as if he would ever smile again and after a week of it I felt that I never should.

Blood-sucking midges belonging to other families have also been suspected of transmitting disease, sometimes on moderately good grounds, at others with very little justification, as, for instance, Sambon's hypothesis that *simulium* was the transmitting agent of pellagra.

The importance of mosquitoes as vectors of several diseases is, however, so well known that there is small need for me to dilate upon it. Yet the anopheline mosquitoes of Australia are little known and such nucleus of knowledge as exists is confined to a few entomologists. As large numbers of men infected with malaria have returned to the temperate parts of Australia, in which no primary malaria was previously known, and as such men can act as reservoirs of infection, this matter assumes an importance which it did not before possess. A

few cases of primary malaria have already occurred in New South Wales and, though this need not indicate any very general spread of infection, it at least shows that our local anophelines are capable of acting as intermediate hosts for plasmodium.

The slides shown upon the screen indicate the marked differences between the anophelines and culicines, which are obvious at all stages. These are well enough known, but it may be worth while briefly to recapitulate them. The anopheline lays its eggs singly upon the surface of the water; in the culicinæ they are glued together in masses, the egg-rafts. The anopheline larva, when breathing at the surface, applies the ventral side of its body to the surface film and has no long respiratory siphon at the posterior end; the culicine, on the other hand, has a long siphon which is pushed up into the air while the body of the larva hangs down into the water at an angle of 45°. The differences between the nymphs are not quite so obvious, but that of *anopheles* has shorter respiratory trumpets upon the thorax and its body is more curved than that of the culicine. Finally, the anopheline imago has its wings patterned with coloured scales, the female has palps as long as the proboscis and the insect normally assumes a resting position with its head down and its body inclined at an angle of 45° to the substratum. The female culex, on the other hand, has very short palps and clear wings and rests with its body horizontal and parallel to the substratum.

Control measures against mosquitoes have also been thoroughly well worked out and their adequacy has been amply proved by the success of such work as that of Ronald Ross at Ismailia and Gorgas in the Panama Canal zone. It seems advisable that a preliminary malaria survey should be undertaken, especially in Queensland and the Northern Territory, as we know little about the distribution of malaria in Australia and still less about the mosquito species which act as vectors.

While in Baghdad I was for a time associated with Major S. R. Christophers, the malaria expert of the Indian Medical Service, and was interested to observe his very simple method of examining pools for the presence of anopheline larvæ. He rapidly stirred the mud at the bottom of a pool and the larvæ, if present, immediately rose to the surface and assumed their characteristic position, closely applied to the surface film.

The family *Muscidæ* includes both biting and non-biting flies. Of the former, the tsetse flies, which carry the trypanosomes of sleeping sickness, are so well known that I do not intend to say anything about them, though I show a few characteristic figures upon the screen. A few other biting muscids have been suspected of transmitting disease. Thus *Stomoxys calcitrans* was at one time suspected of being the vector of infantile polio-myelitis, though this view has now been discarded. Biting arthropods of any kind must always be suspect, apart from the risk of mechanical introduction of infection by the act of insertion of their mouth parts, for their habit of injecting salivary secretion containing an anti-coagulin into the wound and so into the blood stream. It is this habit which renders the transference of a parasite by a biting insect such an easy matter. It should be remembered, too, that the irritation caused by the actual wounds often induces scratching, with the resultant introduction of infectious material left upon the skin into the small lesions caused by this act. Infection with both typhus and plague is usually brought about in this way.

The Life History of Flies.

The non-biting flies include the blow flies, flesh flies, house flies and their allies. These flies all have similar habits and their importance as vectors of disease depends upon the degree in which they are associated with man. The house fly undoubtedly thrusts its unwelcome company upon us to a greater extent than any other fly and its life history and habits may serve as a type for all.

The female house fly produces six hundred to seven hundred eggs, laid in four batches of, roughly, one hundred and fifty each, in the crevices and on the underside of suitable material for the nourishment of its larvæ. This material may consist of almost every kind of decaying organic refuse, human dejecta, horse manure and food refuse being especially favoured. A certain amount of moisture and heat of fermentation are necessary for the successful development of the eggs. Eggs are laid at any time of day except during the periods of maximum and minimum temperatures.

The incubation period varies with the temperature. Under favourable hot weather conditions it may be as short as eight hours. Normally it is about twenty-four hours. The larva issues from the egg as a small white maggot, legless, sightless, tapering very markedly towards one end, the head, where a small, black, hook-like structure, the buccal armature, with which it tears its food, is visible. At the blunter and broader hinder end are two brown spiracles, by means of which the larva breathes. It immediately begins to feed voraciously, just below the surface of the breeding material, where the temperature is not above 50° C.. The larval period occupies from two days in hot weather to eight or more days under colder and less favourable conditions. During this time the larva twice casts its skin. When full fed, it measures over a centimetre in length and is of a creamy colour, due to the absence of dark food material in the gut and to the presence of a yellow fat body. It now migrates from its breeding ground to a suitable place for pupation. Such place is generally at a depth of two to five centimetres round the edges of the heap of breeding material, but larvæ will often migrate quite considerable distances before pupating. They can also penetrate one and a half metres or more of loose earth. When they leave the actual food material, they usually pupate in crevices in the ground round about or under collections of earth or litter of any kind.

The puparium is only half the length of the full-grown larva and is a barrel-shaped body, the outer covering of which is formed by the shrunken larval skin. It is at first white in colour, but gradually changes with age to dark brown. The pupal stage is a quiescent stage, during which all the internal structures of the larva are broken down and built

up again into those of the adult fly. Its duration varies with temperature, but generally corresponds with that of the larval period.

The adult fly emerges from the pupa case and forces its way up through the earth which covers it by means of the contractions and expansions of a sac situated in the top the head, the ptilinum. Its coloration is not developed, nor are its wings unfolded and it walks about until these further developments take place under the action of the sun's light and heat. Several days elapse before it reaches sexual maturity. The sexes are easily distinguished by their eyes, those of the male being in contact, those of the female more or less widely separated.

The fly feeds entirely upon liquid food. When it attacks solids, such as sugar, it regurgitates fluid from its crop on to the sugar and sucks up again some, but not all, of the solution thus made. As the contents of the crop constitute quite an effective culture medium, it is easy to see how a fly coming to food intended for human consumption after feeding upon fæces, sputum or other infected material, may transmit infection to man. The fly usually defæcates whilst feeding and the contents of its gut swarm with bacteria, which are thus passed on to food. Eggs of intestinal worms and the encysted stages of parasitic protozoa are also passed in this way. A third method of infection is mechanical, small particles of fæces and other material being carried upon the hairy feet and body of the fly and being transferred in this way to food.

The normal dispersal of flies from the place in which they breed is not very wide. Provided they find suitable conditions of food and shelter, they do not go more than a few hundred metres. A strong wind will, however, carry them distances of upwards of one and a half kilometres. But they are very easily carried long distances upon the bodies of men and animals and in boats or land vehicles and there is no limit to the possibility of dispersal by these means.

The activities of flies and their powers of annoyance are directly influenced by temperature. At 10° C. they are torpid. They are most active when the temperature is between 27° C. and 37° C.. When the thermometer rises over 38° C. they seek cool shelter and a temperature of 43° C. is fatal to flies in the open. Moisture also has an influence and flies become "sticky" and especially annoying when the air is moist and warm. The diurnal habits of flies, such as their movements, the times they seek food, shelter, etc., may easily be ascertained by simple observations. They usually seek the shelter of houses in the morning as the sun gets hot. They dislike dark shadows and usually enter a window or door along a shaft of sunlight. During strong winds they seek shelter on the leeward side of buildings and pass in through apertures on that side. As the evening becomes chill, that is to say, just about sundown, they swarm in for warmth for the night. Familiarity with these habits, which vary, of course, according to the season, makes it possible to have houses open for adequate ventilation during the greater part of the day and by closing dangerous aspects at dangerous times to secure comparative freedom from flies without taking any other measures at all.

The Insect Problem in Mesopotamia.

Passing to my own work in Mesopotamia, I was appointed by the War Office in April, 1916, to act as Advisory Entomologist to the Expeditionary Force engaged there, a force at that time under the direction of the Indian Government. The reason for the appointment of an entomologist was obvious enough. Plagues of flies, similar to those experienced in Gallipoli by the Australian Imperial Force, appeared during the spring and autumn, giving rise not only to grave discomfort, but also to a very heavy disease incidence, chiefly dysentery and the enteric group.

The Indian Government had become seized with the importance of combating this menace and had sent out Professor Maxwell Lefroy and Captain C. F. Beeson, the Indian Forest Entomologist, a couple of months before I arrived in the country. These gentlemen saw the front area under plague conditions in April, but by the time I arrived, at the end of May, the onset of the summer heat had reduced the flies to reasonable proportions. Professor Lefroy had already returned to India and I joined Captain Beeson at Amarah and we roughed out a plan of campaign based upon the experience which Captain Beeson had already gained.

The whole trouble was obviously due to faulty sanitation. Shallow trench latrines were in general use and we found that these provided absolutely the optimum conditions for flies to breed through successfully, namely, moisture and shelter from the direct action of the fierce sun. Equally obviously, incineration was the remedy. In a country entirely devoid of fuel and of materials for the construction of incinerators and with an inadequate river transport, which would have prevented materials being brought to the front, even had they been available at the base, it was easier to prescribe incineration than to carry it into effect. Experiment proved, however, that dried litter from the animal lines afforded a reasonably suitable fuel and that of such material as puddled mud—the mud of the country was peculiarly tenacious and could be obtained in unlimited quantity by mixing the waters of the Tigris with the surrounding desert—kerosene tins, of which a certain number were available, and the hoop-iron bands off compressed fodder bales, incinerators might be constructed which, whatever they might lack æsthetically, actually incinerated when fanned by the prevalent *shamal,* the hot northerly wind of the country.

I left Amarah early in July, on the same day that Sir Victor Horsley died there of heat stroke, to join the Headquarters Medical Staff of the Tigris Corps, as the force of four divisions, with some odd details, was officially designated, and to take charge of operations, entomological, not military, in the front area. Here I was fortunate in finding a sympathetic Assistant Director of Medical Services (Sanitary) in the person of Major J. W. Graham, Indian Medical Service, who had already done important work in the Suez Canal zone and whose personal kindness and official backing lightened what

looked like a heavy undertaking. A little later Colonel Starr, Royal Army Medical Corps, who, as Assistant Director of Medical Services of the Seventh Indian Division operating on the left bank (Sannaiyat Line) had done notable sanitary work, became Deputy Director of Medical Services, and I had his weight behind me also. This official backing was very essential to success, as my capacity was purely advisory and I had no executive authority.

In the height of the summer, with the shade temperature over 43° C. every day and on occasion ranging up to 54° C., it was too hot for flies to exist and the potential menace lay in the pupæ æstivating underground, where they could not be attacked. The problem was, then, to improve the sanitation to such a pitch that, when these flies emerged in October, they would find no material in which to breed.

The area with which I had to deal, was roughly forty-eight kilometres long, from the advanced base at Sheikh Saad to the front line on the right bank at Es Sinn, with an average width of about eight kilometres. Several factors favoured success. To begin with, there was no native population to complicate matters, the whole area being in complete military control. Then the presence of Indian sweeper personnel—three of the four divisions were Indian—to a great extent solved the labour question. Finally, the summer heat desiccated and rendered innocuous all the remains of past sanitary misdemeanours and enabled animal litter to be thoroughly dried.

During the two and a half months of immunity from flies, incinerators were gradually extended throughout the whole area and the importance of keen sanitary discipline impressed upon all units. The result was quite undramatically successful. In October flies appeared in comparatively small numbers, but, except in a few instances where gross breaches of sanitary discipline occurred, they were unable to breed in any number and the fly plague did not eventuate. Nor was there any general recrudescence of it, except in limited areas, during the two years that I was in the country.

In February, 1917, the advance on Baghdad took place. Baghdad presented a more difficult problem, complicated by the presence of a large native population, the traditional habits and religious prejudices of which had to be carefully handled. The use of human ordure as manure and of animal dung as fuel, as well as the total lack of any idea of sanitation amongst the lower grades of the population, rendered complete success a difficult matter, if not an unattainable ideal.

Baghdad was, however, cleaned up for the first time in its history and the better part of the town was certainly as fly-free as, say, the city of Sydney. But it was a constant fight to keep the food bazaars and the slum quarters of the outskirts of the city in decent condition, more especially as my services were required frequently at various points on the front line, which now spread from Fellujah on the Euphrates through Samarrah on the Tigris, one hundred and twenty-eight kilometres above Baghdad, to east of Baqubah on the Dialah River, over near the Persian border.

My chief grievance against the military authorities was that I was never allowed to suggest or make any sanitary preparations for military operations. These operations were so secret that, although supply, transport, ammunition, etc., had to be arranged for, the sanitary staff must not be allowed to hear of them at all. As for weeks before any operation all the available motor transport was concentrated along one road, everybody, including the native population and the Turks, knew all about the operations long before they commenced. So, not being *pukka* army, I found it difficult to visualize the necessity for this cumbrous pretence of secrecy.

The upshot was that during all subsequent operations all sanitation was allowed to slide until the battle was won or lost. The motor transport did what it pleased, where it pleased. The cavalry followed suit. The infantry were a little better, but not much. They passed through a previously clean town, such as Fellujah, in the advance on Ramadie and left it filthy. The same thing happened to Samarrah in the advance on Tekrit. And when all the mischief was done, I was hastily sent for to come and clean up the mess. Once a fly plague is in existence it is not easy to deal with it satisfactorily, except at great expense in labour and material. In my experience the only satisfactory means of fly control lies in the prevention of breeding by suitable disposal—preferably complete incineration—of all organic refuse. As most of the trouble might have been obviated by taking a little forethought, I commend to any army medical officer who may happen to read this address, the idea that sanitary staff work is just as necessary during operations as in standing camp and that it is quite feasible if confined within practical limits.

So much for fly control in Mesopotamia. The mosquitoes were in the care of Major Christophers, so that I was but little concerned about them. Both typhus and relapsing fever were rife amongst the Turks and typhus broke out amongst the famine-stricken Kurds on the Persian border, so measures against lice became very important. We had, as a matter of fact, only a few isolated cases of these diseases amongst our troops. But lice are not flies and do not concern my present subject beyond the fact that I finally went down to typhus myself while carrying out some experimental work in the Isolation Hospital at Baghdad and after a very narrow shave was invalided to India and was still there when the armistice came to release me.

Need for Preventive Medicine in Australia.

If I may be permitted to point a moral to these discursive remarks, I would suggest that there does not seem to me enough interest in preventive medicine in Australia and that preventive medicine is both a necessary and a desirable thing. After ignoring our hookworm trouble for decades, we have now allowed an American Commission to undertake the task of cleaning it up. I am aware that financial considerations had much to do with this, but it seems to me that it was our own business. If we develope primary malaria and bilharziosis in New South Wales as the result of bringing in reservoirs

of infection and taking no further interest in them, shall we again wring our hands until we receive American charity?

I may be quite wrong, but, after seeing the number and variety of the diseases conveyed by blood-sucking insects in tropical countries and knowing the number and variety of these same types of insects in Australia, I cannot help believing that we still have a great deal to find out here and it is quite obvious that very few people are engaged in the task of finding out.

I feel sure, too, that the few men who are in administrative public health positions, would be greatly helped in their heavy task, if they were backed by the medical profession as a whole. As things are, the public imagines that it is their business in life to make fusses about things and does not take their utterances so seriously as it would a general expression of opinion of a responsible medical body.

I make these remarks, not in any spirit of criticism, but rather in the hope that a wide and unexploited field may receive some of the attention which I think it deserves.

SOME FACTS REGARDING THE BIOLOGY OF THE HOUSE FLY.

By T. Harvey Johnston, M.A., D.Sc.,
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As the Queensland Branch of the Public Health Association of Australasia is endeavouring to stimulate interest in regard to fly and mosquito control by means of its recently issued pamphlet, prepared by the Queensland Branch of the British Medical Association, I have thought it advisable to bring the following facts before the medical profession of this State. They should be of interest to all those connected with Australian public health administration.

It is surprising that, with the exception of three stray references, there is not a solitary fact published relating to the life history of the common house fly (*Musca domestica*) based on observation in any part of Australia. Of these three references, one by Dr. Willis relates two observations on artificially incubated material in Sydney,[1] the second is contained in a paper by G. Hill[2] and the third in an article by Miss Bancroft and myself relating chiefly to the biology of certain "bush flies."[3] In all three instances, comprising a total of only four observations, the records relate to a summer period.

In this paper all temperatures, unless otherwise stated, are air temperatures and not that of the material in which the flies were breeding.

The only paper published relating particularly to the biology of the house fly in any part of this continent is that by Willis.[1] The amount of local data relating to the life cycle of the insect contained in that article is very meagre indeed. The investigation was carried out in Sydney during November and December, 1910, and the flies under observation were kept in an incubator (with the door open) at a fairly uniform temperature, 28° C. to 30° C. (i.e., about 82° F. to 86° F.) in one case and 30° C. to 34° C. (86° F. to 93° F.) in the other. As the breeding material was kept on wet sand, the conditions were approximately those of the humid months of tropical and sub-tropical localities. Consequently, the observations are of no particular value unless this be recognized and are probably useless as a record of what occurs under natural conditions in Sydney. In the former case (82° F. to 86° F.) he reported that the shortest time which elapsed between deposition of the egg and emergence of the fly resulting from the development of such egg, was twelve days, while at the higher range of temperature (86° F. to 93° F.) it was just under ten days. He stated that pairing appeared to occur two days after emergence and that four days later eggs were laid.

A casual reference by Hill[2] indicates that during a Melbourne mid-summer, eggs required from twelve to twenty-four hours to hatch and that flies emerged about fourteen days after egg deposition, mated in from four to six days and egg-laying occurred about four days after copulation.

When dealing with the life cycle of certain bush flies, Johnston and Bancroft[3] mentioned that at Eidsvold, in the Upper Burnett district, during November the egg required a day to hatch, that the first and second instars of the larva each were passed through in a day, while the third instar occupied three or four days, hence a total period of from six to seven days was passed through in the combined egg and larval stages. The pupa needed nine to ten days for its development, so that a total of from fifteen to seventeen days elapsed between the deposition of the egg and the emergence of the resulting fly. These figures, which, by the way, relate to a hot, dry month, are the only ones published relating to the length of time occupied by the house fly in passing through its various stages under natural conditions in Australia. From the dates given in the two sets of observations recorded by Willis, it will be noted that eggs hatched in about a day, the larval stages required five to six days and the pupal four days, under hot, moist conditions.

A series of observations of limited extent was made in Brisbane during the period 1919 to 1921 and the results are embodied in a paper by Q. W. Tiegs and myself,[4] now in the press, dealing with the biology of some of the more common Queensland muscoid flies. Certain information contained in it has been made the basis of this contribution.

On account of the wide field covered by the inquiry, data relating to the length of the various stages were not always obtained, the authors being generally content with observing the length of time which elapsed between the deposition of eggs and the emergence of the resulting flies. During November, 1919, it was ascertained that in Brisbane the combined egg and larval stages required from five to seven days, usually six days, the pupa eight to ten days, usually nine days, giving a period of from fourteen to sixteen days between egg deposition and emergence of the flies which developed from

such eggs during that warm, dry month. During the following January and February (1920), when the moisture content of the air was very much greater, the combined egg and larval stages needed four to six days and the pupal four to eight days, giving a total of eight to twelve days. The work was continued during 1920 and 1921 and it was found that the house fly could pass through all its stages from the egg to the newly-emerged adult in from seven to eight days during mid-summer, eleven to fifteen days during autumn (April and May) and twelve to sixteen days during winter. Copulation occurred in from four to eight days after emergence, eggs being laid four days later. The work was carried out with the use of small quantities of horse-dung, either in jars or in small cages.

It must not be overlooked that the temperature of fermenting horse-dung may be considerably above that of its surroundings, the temperature varying with the degree of fermentation; and this depends partly on the moisture content, the bulk of the mass, the position in the mass and the age of the material.

Herms[5] mentioned that young fly larvæ are most numerous in manure at a temperature between 45° C. and 55° C., *i.e.*, 113° F. and 131° F., but Hewitt[6] has stated that a temperature of 40° C. (104° F.) is too great for fly larvæ, even 38° C. (100° F.) causing them to be uncomfortable. The latter author published some observations regarding the temperature of manure piles and reported that with an air temperature of 30° C. (86° F.) a three-day-old manure pile was 36° C. (97° F.) on its surface, 69° C. (156° F.) at a depth of ten centimetres, increasing with depth; while in another case, with the air temperature at 25.5° C. (78° F.) the surface of a two-day-old pile was 30.5° C. (87° F.), at 2.5 centimetres depth 41.1° C. (106° F.) and at ten centimetres 62.8° C. (145° F.). Consequently, owing to the excessive heat, larvæ were forced to live in the superficial portions of a well-packed manure pile, penetrating more deeply in looser or smaller (and consequently cooler) masses of horse manure.

Stiles has recently[7] pointed out that fly larvæ reach maturity in minimum time in fermenting material at a temperature between 32.2° C. and 36° C. (90° F. and 98° F.) and will leave those parts which are hotter (say, 38° C. to 43° C.). He found that at a temperature of 18.3° C. to 23.9° C. (65° F. to 75° F.) about three weeks were occupied in the combined egg, larval and pupal stages.

Herms has published some data regarding the amount of infection observed in manure dumps at Berkeley, California. Four samples were taken after four days' exposure. The first collection (1.8 kilograms) yielded 6,873 larvæ, the second (1.8 kilograms) 1,142, the third (1.8 kilograms) 1,585, the fourth (1.4 kilograms) 682; total, 10,282 larvæ in 6.8 kilograms of manure, an average of 1,512 per kilogram of manure, most of them being practically full grown. The pile was estimated at 454 kilograms and two-thirds of it was regarded as being infested, so that approximately 900,000 larvæ per 100 kilograms (one ton) of manure were present. In view of the remarks made by Hewitt regarding the temperatures of manure piles and the fly distribution in them, the writer is inclined to doubt the accuracy of the statement that two-thirds of the large four-day-old pile (which must have been actively fermenting) were infested.

Egg Stage.

The minimum time recorded as necessary for hatching of the larva after deposition of the egg appears to be eight hours. Twelve to fourteen hours were recorded for Melbourne mid-summer and Brisbane results were similar. Newstead and Hewitt reported that eight to twelve hours were needed at a temperature of 25° C. to 35° C. (77° F. to 95° F.), twenty-four hours at 15° C. to 20° C. (59° F. to 68° F.) and two to three days at 10° C. (50° F.). Herms recorded the results of his observations as follows: At 30° C. (86° F.), eight to twelve hours; at 25° C. (77° F.), twelve to twenty hours; at 20° C. (68° F.), twenty to thirty hours; at 17.8° (64° F.), twenty-seven to thirty hours; at 16° C. (61° F.), thirty-six to forty hours.

Bishopp reported that eggs hatched in less than twenty-four hours, even during winter, at Dallas, Texas, the monthly mean temperature during the observations being: November, 17.2° C. (63° F.); December, 7.2° C. (45° F.); January, 11.1° C. (52° F.); February, 6.1° C. (43° F.). It may therefore be stated that in Australia house fly eggs will probably hatch in from eight to twenty hours during summer, in twenty to thirty hours during spring and autumn and in from twenty-four to forty hours during winter, except perhaps in very cold localities.

Larval Stages.

The minimum recorded for the three instars seems to be just under three days (Bishopp, Texas), which probably also represents the time taken under moist tropical and sub-tropical conditions. Pierce quoted four days as a minimum at Washington, D.C.; Howard gave five. Herms reported five to six days at 30° C. (86° F.), seven to eight at 25° C. (77° F.), eight to ten at 20° C. (68° F.), ten to fourteen at 17.8° C. (64° F.), eleven to twenty-six at 16° C. (61° F.) at Berkeley, California. A period of five days was Hewitt's minimum in Manchester at a temperature ranging from 25° C. to 35° C. (77° F. to 95° F.). The normal during warm weather at Dallas, Texas, was reported by Bishopp to be four to seven days, increasing to three weeks or more as the temperature fell. In Brisbane during summer the larval stages normally occupy four to five or six days if moisture be sufficient; and this probably holds good for all the Australian capital cities on the mainland during that time of the year. The minimum observed by us in Brisbane (January and February, 1920) was three and a half days.

The combined egg and larval stages, *i.e.*, from the deposition of the egg until the commencement of pupation, was found by us to occupy from four to six days during the moist mid-summer months in Brisbane, but five to seven during the drier summer months. The length of the period during the rest of the year was not noted. The minimum reported in the United States of America is four to

five days, the time extending to many weeks under less favourable conditions.

Pupal Stage.

The larva, after having completed its third instar, may wander to some suitable position, such as under débris, in order to undergo pupation. Very many burrow into the soil in the vicinity of the manure heap. Hewitt found the greatest number occurring in soil about forty-five centimetres (eighteen inches) away from the base of the pile and at a depth of from thirty centimetres to sixty centimetres, the numbers diminishing outwards to a distance of about 1.2 metres from the base, and from such buried pupæ (even those at a depth of sixty centimetres) flies emerged. This wandering and burrowing habit of the fully developed larva is worthy of remark, as it emphasizes the danger from flies breeding in human excreta and house refuse under the weekly system of collecting night-soil and garbage in vogue in Brisbane. We have pointed out that during mid-summer three and a half to four days only are needed for the fly to pass through its early stages, the larva crawling away, if possible, in order to undergo pupation. The danger from leaky receptacles, which either allow the escape of the larvæ or the escape of the more or less liquid fermenting contents into the underlying soil where fly larvæ can develope freely, is also deserving of notice.

The pupal stage varies very greatly in duration, according to temperature and humidity. Low temperature or dry conditions lengthen this condition. The minimum period reported from England is three to three and a half days at 35° C., three days in Washington, D.C. (generally five days in mid-summer, ranging to five months in winter), three in Dallas, Texas (ranging to two months in winter). Herms recorded the following periods in Berkeley, California: At 30° C., from four to five days; at 25° C., seven to nine days; at 20° C., ten to eleven days; at 17.8° C., twelve to fifteen days; at 16.1° C., eighteen to twenty-one days. The minimum observed by us in Brisbane was four days in January and February, but in view of the three-day periods recorded as having been noted in the United States of America and England, it may safely be assumed that three-day minima are certainly to be met with in the coastal districts of New South Wales and Queensland and even elsewhere in Australia during hot, moist weather.

It is worthy of note that in Brisbane during the hot, dry month of November, the pupal stage occupied generally nine days (eight to ten), but during the following January, a moist month, from four to eight were needed. Over-wintering seems to occur in colder climates mainly in the pupal condition, though in sheltered spots larvæ can continue to feed, while adults which emerge during winter, may lay eggs from which larvæ hatch out. In warmer climates, flies breed and larvæ feed throughout the winter, the larval and pupal stages being rather longer than in summer. We have no record as to what occurs in any of the other Australian States, but the climatic conditions in Eastern Texas (*e.g.*, Dallas) are similar to those in Sydney, Melbourne, Adelaide and Perth.

Total Larval Period.

This extends from the deposition of eggs to the emergence of the flies which have ultimately developed from such eggs. It is a very important period from the point of view of public health. The minimum period observed by us was seven days, the usual time in Brisbane during the season January to March being seven to twelve days, lengthening to from eleven to sixteen during autumn and winter. When conditions were dry, a longer time was required, but our observations on this point were incomplete. Willis reported twelve days at temperatures between 27.8° C. and 30° C. and under ten when they ranged between 30° C. and 33.9° C.. Hill recorded fourteen days in Melbourne (mid-summer). The minimum observed in England during mid-summer was eight days, though the normal seems to be nine to ten, and Hewitt reported that at an average daily temperature of 22.5° C. (72.5° F.) in England from fourteen to twenty days were needed. The minimum known in the United States of America seems to be eight days, though ten to fourteen are more common during mid-summer (Washington, D.C.; Dallas, Texas). Bishopp[8] at the latter locality found that eight to eleven days were required during mid-summer and twenty-five to fifty-one during mid-winter and reported one case where six months elapsed. Stiles stated that at temperatures of 18.3° C. to 23.9° C. in the United States about three weeks elapsed.

Herms has given us very useful information in regard to the effect of temperature. At 30° C. (86° F.) the minimum period noted was 9.3 days, the maximum 11.5 days and the average 10.4 days; at 25° C. (77° F.) the periods were 14.5, 17.8 and 16.1 days respectively; at 20° C. (68° F.) 18.8, 22.25 and 20.5 days; at 17.8° C. (64° F.) 23.2, 30.25 and 26.7 days; at 16.1° C. (61° F.) 40.5, 48.6 and 44.8 days respectively. It will be noted that his results (for 17.8° C. to 20° C.) obtained in California agree more or less with those given recently by Stiles for temperatures between 18.3° C. and 23.9° C., presumably for Washington, D.C., and those given by Hewitt (22.5° C.).

Eight days is recorded as elapsing in Northern India, but is probably not a minimum. In Southern India Patton reported that flies emerged on the sixth to seventh day after the eggs were laid, while Austen[9] mentioned that during a very hot mid-summer in Rouen, France, he observed a case where a little over six days were needed and in May, 1916, at Suez Canal seven and a half days elapsed.

From these data it may be assumed that along the coastal districts of Queensland and northern New South Wales which are subject to summer rains, flies may emerge in mid-summer in a week from the time that eggs are laid. In the coastal regions of New South Wales, Victoria, South Australia and South-Western Australia probably about nine to fourteen days are required, according to the humidity, though a succession of mid-summer thunderstorms would almost certainly diminish the period to about a week. Of course during autumn and winter these periods would be greatly lengthened, but no data are available.

A variable period necessarily elapses between the time of emergence of a female fly and its oviposition. This has been termed the pre-oviposition period. During it copulation is effected, this having been observed to occur in the United States of America as early as the first day after emergence and as late as the forty-seventh in a case of flies kept at a rather low temperature (— 1° C. to 15.5° C., *i.e.*, 30° F. to 60° F., daily range). Four to nine is the usual summer period at Dallas (daily mean temperature, 20° C. to 30.5° C.); ten days during autumn. The normal seems to be three to six days. Our observations on this point were casual, a period of four to eight days being the earliest noted by us, though Willis observed copulation on the second day (temperature, 30° C. to 33.9° C.) and Hill on the fourth to sixth day in Melbourne during mid-summer. The shortest pre-oviposition period observed by Hutchison,[10] who has especially studied the question, was two and a half days (one record) in Virginia during mid-summer at an average mean temperature of 28° C.; he noted several records of three days (at temperatures of 26.2° C., 27° C. and 27.8° C.), four days (27.8° C., 27.8° C., 26.3° C., 23.6° C., average 26.4° C.), five days (23.3° C. to 25.5° C.), six days (20.5° C. to 26.6° C.), lengthening to twenty-three days as the temperature diminished. Bishopp and his colleagues in Texas observed a four-day record at an average mean temperature of 30.8° C.. In England Hewitt found it to be fourteen to eighteen days.

The only pre-oviposition periods previously recorded as Australian observations were those of Hill, eight to ten days (Melbourne mid-summer), and Willis, six days (Sydney, 30° C. to 33.8° C., *i.e.*, 86° F. to 93° F.). Our records show eight to twelve days, but almost certainly do not represent the minimum period in Brisbane, as it is probably about three or four days during mid-summer (January to March).

Both Bishopp[8] and Hutchison[10] found that bred flies oviposited only twice (at about eight days' interval), though it has been stated that four batches may be deposited at intervals of ten to fourteen days. The number in each batch was found to vary between twenty-five and ninety-six (Hutchison).

Austen has pointed out that in England during very hot weather only about three weeks might elapse between egg laying by a fly and by the flies which developed from such eggs, in other words, a complete generation. Howard and Hutchison[11] showed that such would be possible in eleven and fourteen days in Washington, D.C., during mid-summer. Willis, using a temperature which varied between 27.8° C. (82° F.) and 33.8° C. (93° F.), observed that this period was eighteen days, while the time from emergence of a fly to the emergence of its progeny (30° C. to 33.8° C.) was sixteen days.

Longevity of Flies.

The longevity of flies in captivity has been recorded by various observers, but the results cannot be accepted as giving an accurate representation of what actually occurs under natural conditions. It has been found by Hutchison[10] to vary in the United States of America from one to fifty-four days, with an average of a little over nineteen days (based on three thousand flies under observation), though he recorded periods of thirty-five to forty days (18.3° C. to 23.8° C.), seventy days (— 1° C. to 15.5° C.) and even ninety-one days (6.6° C. to 13.8° C.). Bishopp mentioned two to fifty-three days as limits, but generally two to four weeks in summer. Herms recorded up to sixty days (average thirty) in San Francisco. Austen and Griffiths mentioned an instance of a fly surviving for sixteen weeks in England. Under our warmer climatic conditions in Brisbane the life of the house fly is probably shorter than in Texas, which is more like the southern capitals climatically.

Hutchison[12] in his studies on the question of over-wintering of the house fly has published some interesting data on this point. He found that in Virginia a temperature of — 12° C. (10° F.) was fatal, but that flies could revive after exposure to — 5.5° C. (22° F.), that they became inactive at temperature below 4.4° C. (40° F.) and mentioned that copulation was not observed under 12.8° C. (55° F.). Longevity ranged from eighteen to forty days when the winter temperature ranged between — 5.5° C. and 26.1° C. (10° F. and 79° F.), daily extremes; forty-one to seventy-two days with temperatures from — 1.6° C. to 16.6° C. (29° F. to 62° F.), mean, 6° C.; fifty-two to fifty-four days with temperatures from 1.6° C. to 24.4° C. (35° F. to 76° F.), mean, 13.8° C..

Range of Flight.

The range of flight of the house fly is of extreme importance from the point of view of public health. We have no Australian data to offer, but desire to draw attention to the valuable results recently obtained by Bishopp and Laake[13] in Dallas, Texas. By means of suitable traps, placed at varying distances approximately north, east, south and west of a certain locality and using large numbers of marked flies they found that both males and females of *Musca domestica* readily travelled for miles, the maximum observed being 21.2 kilometres (13.14 miles) from the point of release. Dispersion occurred in all directions, being greatest with the wind, but was very marked against the wind as well as across the wind.

This dispersion could be effected very rapidly, as some marked flies were recovered in less than twenty-four hours in traps over 9.6 kilometres (six miles) from the point of release. The stimuli inducing dispersion were mainly desire for food and desire to reach suitable places for oviposition, but, in addition, there was proved to be a migratory instinct, since abundance of flies passed over suitable feeding and breeding places before reaching the traps in which they were captured. It is of interest to note that some marked flies were re-caught no less than fifteen days after their release. These authors emphasize the fact that in any campaign for fly suppression in a locality, all possible breeding places for many miles around must certainly be taken into account, owing to the proved ability of the insect to travel rapidly over very considerable

distances and to become widely dispersed, even against the wind. Willis, in his article, referred briefly to the range of flight and pointed out that English observations showed that flies could travel about 0.8 kilometre (half a mile) in thirty-five minutes and that the range was nearly 1.6 kilometre (a mile) with the wind. The investigations of Bishopp and Laake mark a very distinct advance in our knowledge regarding fly dispersion.

The only one who has recorded fly captures in houses in Australia seems to be Professor J. B. Cleland,[14] whose observations extended from November, 1909, to April, 1911. From the figures which he gives, one can calculate that 98.2% of the total flies caught by means of "Tanglefoot" paper on a breakfast table in a suburb of Sydney during that time were *Musca domestica*, 1.6% were *Fannia canicularis*, the balance consisting of a few specimens of *Muscina stabulans*; and of those captured at the mid-day meal during the same period 98.4% were house flies and the rest *Fannia canicularis*. Of the total captured at both meal-times, 98.24% were house flies and 1.6% were *Fannia canicularis*. Our own counts gave approximately 98% of house flies caught in a similar way in a Brisbane suburban house over a period of some months (1921). The other flies were *Fannia canicularis* and a few *Muscina stabulans*, as in Cleland's observations.

The Flesh Flies (Sarcophaga spp.).

These rather large grey blowflies, which resemble overgrown house flies, but which have three distinct dark stripes on the thorax instead of four as in the house fly, do not seem to have received the attention they deserve as potential carriers of disease organisms. They are very common and are readily attracted to carrion of any kind and to all kinds of fæces, as well as to ripe fruits and meat. We have bred them from meat, human excreta, horse-dung, rotting fruit and potatoes, though they prefer fæces and decomposing flesh. Several species are known to have caused human myiasis by depositing their larvæ in wounds.

On account of the extreme readiness with which these flies visit human excreta as well as food-stuffs, we have bred some out from human fæces, amongst them being *Sarcophaga peregrina*, *Sarcophaga eta* and others. As practically all the known Australian species have similar habits, we can safely assume that most of them are able to breed in human fæcal material, which is so frequently exposed to their attention, not only in the country districts of Australia, but also even in unsewered cities like Brisbane where the pan system is still in operation.

Some information regarding the biology of certain species is now being published by Mr. Tiegs and the writer.[4] It has been ascertained that the larva feeds for from three to six days during summer (October to April) and seven days during winter; then there follows a pre-pupal period during which feeding does not occur, but the larva wanders away to some suitable spot where it may pupate. These larvæ have numerous small spiny processes on their bodies and by means of these they are able to climb fairly well and are thus often enabled to scale the sides of soiled garbage tins and night-soil receptacles to escape into the soil or under shelter. This pre-pupal condition lasts for two to three days in summer (November to April), lengthening to seven and eight days during winter and spring, so that the total time passed in the larval stage is from six to nine days during summer and eleven to fifteen during winter and spring.

The pupal stage may be short (five to nine days) in summer, but extending to several weeks (up to at least ten) during winter. The period from larviposition by a female to the emergence of the new fly may vary from twelve to eighteen days in summer, but increasing to ten or twelve weeks as the cold weather advances.

The fly undergoes copulation in two or three days (sometimes as late as eight days) after emergence and begins to deposit larvæ about eight days later, so that the pre-larviposition period is from ten to twelve days, usually eleven. Thus the length of time between larviposition by a fly and that of its progency is approximately from three to four weeks in summer, increasing to fourteen weeks in the case of those which spent the winter in the pupal condition. Bishopp and Laake[13] reported that marked specimens of species of *Sarcophaga* were recaptured in traps 4.8 kilometres (three miles) from the point of release, some being retaken eleven and twelve days after their first liberation.

We have not systematically bred out flies from garbage. Paine, in a short article on "The House Fly in Relation to City Garbage,"[16] stated that garbage receptacles were a very important situation for fly breeding, over 22% of those bred out being *Musca domestica* and 50% were *Lucilia sericata*, the common green bottle fly. Cleland[14] has made some remarks regarding the commoner flies attracted to human fæces and to house refuse.

From the foregoing remarks relating to the house fly and the flesh fly it will be seen that, in Brisbane at least, the weekly collection of house refuse and of night-soil affords an interval sufficiently long for both of these scavenging and food contaminating insects to pass through very important phases of their life cycle and escape before the material referred to is destroyed. Of course, it will be said that the receptacles containing the garbage and excreta should be kept properly covered, but we know that this precaution is not always taken and any campaign aimed at house fly and blowfly control must take into account these facts which are now laid before those interested in public health in Australia.

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HABRONEMIC CONJUNCTIVITIS IN MAN PRODUCING A "BUNG EYE."

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RECENTLY we had submitted to us for histo-pathological examination a small tumour removed from the conjunctiva of a child aged thirteen months. The child was under the care of Dr. H. M. Jay, to whom I am indebted for the following clinical notes:

Clinical Notes.

Baby J.E., *ætatis* thirteen months, was seen on May 1, 1922. The history was that five weeks previously the left eye swelled as if bitten. The condition lasted three to four days and was treated with "Golden Eye Ointment." When the swelling disappeared a lump was seen. This seemed to go away, but the lid appeared blue and the child would rub it. On examination a small moriform body was seen under the upper lid of the left eye at the outer canthus. On May 4 the small tumour was removed from the tarsus and the base touched with copper sulphate.

Pathological Findings.

Macroscopically the tumour is seen to have a diameter of approximately three millimetres. The surface is only slightly irregular. The tissue appears semi-translucent, with one or two opaque points imbedded within it.

Microscopically the tumour is seen to consist of a vascular granulation tissue covered by the conjunctival epithelium, which is slightly hyperplastic in some parts, while thin and eroded in other places. In a section two or three areas of dense cell accumulation are to be seen which take the acid stain intensely. These areas show a maximum diameter of 500 μ, usually contain a more or less circular space towards the centre and are surrounded by a zone of hyperplastic endothelial cells in which multinucleated cells are to be seen. The space in the centre of these areas contains a granular débris, is usually circular and measures 47 μ to 50 μ in diameter. In some sections it is ovoid or elliptical in shape and in one section it is much larger and measures 190 μ across the smaller and 240 μ across the larger diameter. In serial section it is seen that these spaces taper towards either end and disappear before the entire area of cell accumulation has been sectioned. The cells in these areas consist of neutrophile and eosinophile leucocytes, many of which are undergoing early degenerative changes, *viz.*, pyknosis and caryolysis. The mass of the tumour consists of a vascular granulation tissue, somewhat œdematous and containing multi-nucleated cells sparsely scattered throughout and also a diffuse infiltration of neutrophile and eosinophile leucocytes.

Discussion.

The histological picture is striking and totally unlike that of any granulomatous condition of man according to the present writer's experience. It does, however, present a distinct likeness to a granulomatous condition commonly found in horses which is now known to be due to the invasion of the tissues by a larval nematode belonging to one of three species of the genus *Habronema* which in the adult stage are parasites in the stomach of the horse. This granulomatous condition occurs on the external mucous membranes of the horse, *viz.*, conjunctiva and urethra at the orifice, and also on other parts of the external surface of the body and a pulmonary form has been described. It would appear that the larva enters the tissues either by pushing its way through the mucous surface or through an injured skin, but that it is not capable of completing its development in these situations and soon dies.

The three species of *Habronema* known as parasites of the stomach of the horse are *Habronema muscæ* Carter, 1861, *Habronema megastoma* Rudolphi, 1819, and *Habronema microstoma* Schneider, 1866.

The embryos of these worms, still enclosed in the egg shell, pass out along with the fæces. They are liable to be taken up by fly larvæ feeding on the fæces. Ransom(1) was the first to show that the embryos of *Habronema muscæ* are taken up by the larvæ of *Musca domestica* and that they develope through definite larval stages in the larva, pupa and adult and are usually found situated in the head and proboscis of the adult fly.(2) It has more recently been shown by Hill (1918) and Bull(3) that *Habronema megastoma* has a similar life history and that *Habronema microstoma* passes through its larval stages in *Stomoxys calcitrans*. Still more recently Roubaud and Descazeaux,(4) in a study of the development of *Habronema megastoma*, have shown that embryos taken up by the larvæ of *Musca domestica* pass through the wall of the intestinal canal and take up their position in the tubes of Malpighi. The malpighian epithelium undergoes an intense hypertrophic reaction and stretches to form a thin envelope or "cyst" surrounding the larvæ. This separates off and comes to lie in the general body cavity. The larva undergoes three larval stages in the fly, frees itself from the covering epi-

thelium and migrates to the proboscis, from which it may escape by rupturing the articulating membrane of the labellæ.

There can be little doubt that the larvæ found in the granulomata of the horse escape from the proboscis of the fly when the latter comes to feed upon a moist surface. The species of larva commonly found in the granulomata is either *Habronema muscæ* or *Habronema megastoma* and the present writer believes that it is usually or always *Habronema megastoma*. Either of these species may be conveyed by at least six muscids and one sarcophagid (Johnston[5]), but the most usual transmitters, particularly in southern Australia, are *Musca domestica* (the common house fly) and *Musca vetustissima* (the bush fly).

Although the granulomata are definitely due to the invasion of the tissues by the larvæ, probably the majority of the tumours examined, if at all long standing, will fail to reveal their presence. Usually, however, the spaces or worm canals occupied by the larvæ can be detected. The rapidity of the disappearance of the larvæ depends upon the degree of reaction of the tissue and the resistance of the larvæ to destruction, both of which factors appear to be variable. Under experimental conditions it has been observed that the larvæ may be attacked vigorously by the leucocytes, when an acute inflammatory swelling is produced, which disappears in from forty-eight hours to three days or a more chronic reaction may be produced and larvæ can then be detected in the tissues nine days or longer after inoculation.

In the light of our experience briefly summarized above an interpretation of the tissue reaction produced in the conjunctiva of the child may be made and the probable sequence of events suggested. The probable explanation is that flies, either *Musca domestica* or *Musca vetustissima*, came to feed upon the moisture of the conjunctiva of the child and during the feeding operation one or more larvæ of either *Habronema megastoma* or *Habronema muscæ* escaped from the proboscis of the fly and gained the moist mucous surface. From the appearance of the tumour it seems probable that not more than two or three larvæ and possibly only one penetrated beneath the conjunctival epithelium. The irritant effect of the larvæ produced a marked œdema of the tissues which later subsided, but surrounding the larvæ a characteristic tissue reaction was produced. The larvæ quickly died and were attacked by leucocytes which formed a dense mass of cells surrounding them. On the disappearance of the larvæ spaces or worm canals were left in the areas of cell accumulation. The diameter of these spaces agrees with the diameter of the larvæ of *Habronema*. The larger space referred to above has either been occupied by more than one larva or more probably by a coiled larva.

It is unfortunate that the actual proof of the cause of the granuloma cannot be obtained, but the presumptive evidence is very strong and leaves no doubt in the mind of the present writer that the tumour was produced by a larval nematode, most probably of the genus *Habronema*. The possibility of such a lesion occurring in man has impressed him for some time. The fact that such an occurrence has not previously been recorded, is not surprising, as the nature and histo-pathology of habronemic granulomata have not been well understood until quite recently.

It is possible that larvæ may penetrate the conjunctiva of man and undergo a more rapid destruction than in the present case, when little more than an œdema would result. In this connexion it may be interesting to speculate on the possible association of this type of invasion with the more or less common "bung eye" of the Australian bush. As far as we know, "bung eye" is peculiar to Australia and as habronemiasis is a common affection of horses throughout the world, there would be, at first sight, little to support the suggestion that "bung eye" may be caused by larval *Habronema*. It is necessary in this connexion, however, to remember that, as many species of muscids may carry laval *Habronema*, the habit of the fly may be the determining factor. *Musca vetustissima* is a native of Australia and its most characteristic habit is that of visiting the eyes of man and the lower animals. We have here a possible explanation and it may be worth while investigating "bung eye" with the object of testing whether the hypothesis advanced is tenable.

Such an investigation should aim at determining (*i.*) the relationship of flies to the condition, (*ii.*) the probable species of fly incriminated and (*iii.*) the presence or absence of any tissue reaction in the conjunctiva of those affected.

The present writer would be pleased to receive any material from those who are interested and have the opportunity of making observations on this interesting but yet obscure condition.

It is not suggested that so-called "bung eye" is an entity. The suggestion is merely that the invasion of the conjunctiva of man by larval *Habronema* may be more common than is suspected at present and that the invasion may produce a form of "bung eye" which has remained unrecognized.

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THYREOIDECTOMY.

By M. O'Gorman Hughes, B.A., M.B., B.Sc. (Sydney),
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In recording the following notes on thyreoidectomy, let me disclaim any intention of asserting that every goître needs surgical treatment. Between the goîtres of puberty, which usually require no treatment, and the advanced, hopeless cases of hyperthyreoidism there are some cases which give grave anxiety in deciding the expediency of operation, immediate or deferred, and others which may recover without surgical interference. I well recollect one patient with a goître of two years' duration beginning to show toxic symptoms. While in hospital undergoing preparation for operation, she took fright and bolted. Twelve months afterwards the goître, though palpable, was not visible as a neck tumour and was causing neither toxic nor pressure symptoms. Two other cases with a similar termination have come under my notice.

Of the hundred patients operated on, sixty-one were suffering from hyperthyreoidism and thirty-nine from simple goître. The female sex preponderated to the extent of ninety-two to eight.

Of the patients suffering from exophthalmic goître fifty-eight were females and three were males. Of those suffering from simple goître thirty-four were females and five were males.

The ages of all the patients except four were between twenty and forty, the exceptions being fourteen years, eighteen years, fifty-three years and fifty-eight years. The youngest patient, aged fourteen years, suffered from well-marked hyperthyreoidism and the oldest patient, aged fifty-eight years, had a large cystic goître with a recent hæmorrhage into the cyst.

Simple Goître.

Of the thirty-nine operations for simple goître I have seen twenty-two patients since operation and these have all remained well except one, who shows further cystic disease and will require a second operation. One patient died of recurrent hæmorrhage and the remainder convalesced in the ordinary way.

Exophthalmic Goître.

Of the sixty-one patients operated on for exophthalmic goître, two died—one of heart failure a few hours after operation and the other of hyperthyreoidism sixteen hours after operation. Both patients had been suffering for at least five years and had undergone first operations. There were five second operations, that is, for excision of part of the remaining lobe when one lobe and isthmus had been previously removed.

First Operations.

Of the fifty-four patients who survived the operation, two have died later—one of diabetic coma and the other of septic peritonitis following on appendicitis. As regards the death from diabetic coma, there was no trace of sugar detected in the urine while the patient was in hospital for operation twelve months previously and this is the second association of hyperthyreoidism and glycosuria in the present series.

Eleven patients have not been seen since operation and forty-one have presented themselves for examination at different periods over a range of two to five years. Twenty-one have remained well, ten are doubtful, that is, with a pulse rate of ninety to one hundred, and ten show a recurrence of symptoms with a pulse rate of one hundred or over.

Second Operations.

Of the five in this series, four have remained well for at least two years. The fifth showed a recurrence of symptoms twelve months after operation. One patient operated on for the first time in 1912 returned in 1917 with a recurrent hyperthyreoidism and glycosuria. When the sugar in the urine had been reduced to a trace, the second operation was performed. Frequent examinations between 1917 and 1919 failed to find signs of either complaint.

General Results.

Number of Cases	61
Immediate Mortality	2
Death from Other Causes	2
Cures by First Operation	21
Cures by Second Operation	4
Doubtful Results	10
Requiring Second Operation	10
Requiring Third Operation	1
Unknown Results	11

From the examination of patients at present under observation we might say that half are cured by the first operation and of the recurrent cases four-fifths are cured by a second operation.

Preliminary Treatment.

The two patients who died had symptoms of at least five years' duration and it was difficult to obtain a steady pulse rate before operation. Most patients had a pulse rate of one hundred and twenty or over and it has been my practice to keep them in rest in bed till the rate diminishes to one hundred and ten or less per minute. If this decrease does not occur, the operation is much more hazardous and perhaps not justifiable. Under such conditions in future I intend to ligature the superior thyreoid arteries as a preliminary to thyreoidectomy.

Bromides and digitalis have been helpful in the preparation and an exposure to X-rays, tried only in a few cases, did not appear to have any benefit. Vomiting and diarrhœa are contra-indications to immediate surgical treatment.

Anæsthetics.

In three cases local anæsthesia by β-eucaine was used and in the remainder general anæsthesia by ether administered by the open method preceded by a hypodermic injection of ten milligrammes (one-sixth of a grain) of morphine and 0.5 milligramme (one one hundred and twentieth of a grain) of atropine. Local anæsthesia acted well till the stage of lifting the thyreoid lobe off the trachea and then the patients showed signs of distress. After operation the pulse rate was higher than in those cases where ether had been administered.

The Operation.

The operation consists in removing the larger lobe and isthmus of the thyreoid gland at the first operation and half of the remaining lobe at the second. A collar incision is made across the neck through the skin and fascia, as far as possible conforming to the natural creases of the neck. These structures are dissected up to the thyreoid cartilage and down to the sternum. Then a vertical mid-line incision is made and the sterno-hyoid and sterno-thyreoid muscles are separated and well retracted on the side operated on. If more room is required, these muscles are divided high up and clamped for later suture. The areolar tissue is dissected off the gland and the vessels ligated and divided close to the gland.

By securing the superior thyreoid arteries first it is easier to lift out the lobe and then to secure a better view of the side and back of the gland. The middle thyreoid veins are tied and divided and, lastly, the inferior thyreoid vessels. The lobe and isthmus are pushed off the trachea with gauze and removed. The cut surface of the remaining lobe is ligated and cauterized. In a few cases where this cut surface was not cauterized, a discharge of thyreoid secretion persisted for a few weeks. After all bleeding has been arrested, the muscles are sutured in the mid-line and at the side if divided and a subcutaneous-subcuticular suture inserted in the superficial fascia and skin.

Drainage was employed after all operations for exophthalmic goitre through a stab wound below the incision for two to five days and in the cases of simple goître where a large cavity was left.

Tetany was not observed after any of these operations and the hoarseness frequently present after operation disappeared in all but one instance.

After-Treatment.

This consisted in the free use of rectal saline enemata and in supporting the patient in an upright position as soon as the shock of the operation had passed off. The temperature and pulse rate generally reach their maximum on the second evening after operation and the former is usually normal on the third or fourth day. Patients operated on for simple goîtres are allowed out of bed on the fourth or fifth day and those suffering from the exophthalmic type are rested for ten to fourteen days and advised to take plenty of rest for three months after returning home.

Reviews.

INFANT MORTALITY.

The second edition of Dr. Hugh Ashby's book on "Infant Mortality"[1] presents the same plan of subject treatment to be found in the 1915 original edition. In fact, it contains five pages less and costs sixpence more than before, which is evidently the price we pay for service, satisfaction and reliability as the motor journals have it.

The research and learning of the author and the richness of his experience from which he has drawn his conclusions, justify the opinion that this handbook will remain the accepted guide to a most complex subject. It is compact and concise, but gives a comprehensive view of the field in an interesting and readable way, with topics arranged by chapters in the following sequence: "I., Infant Mortality: What It Is and What It Means to the Nation." "II., The General Causes of Infant Mortality: (*a*) Poverty, (*b*) Lack of Proper Knowledge, (*c*) Improper Feeding." "III., The Special Causes of Infant Mortality: (*a*) Preventible, (*b*) Partially Preventible, (*c*) Non-Preventible." "IV., The Ways by which Infant Mortality can be Lowered." "V., Milk." "VI., Ante-Natal Hygiene," etc.

By skilful coordination Dr. Ashby first presents the causal agents and then suggests the remedies that may be relied upon. All measures to insure maternal and child life protection must invariably aim at promoting public welfare and not assume the form of charity or relief work. The possibilities of preventive medicine are beginning to dawn upon the medical profession. Its future lies with a fence at the top of a precipice rather than an ambulance at the bottom. Public Health is purchasable and within certain limits any community can determine its own death rate. The infant, the parent and the State are so intimately intertwined that successful dissociation is impossible. We must aim at giving every child a chance and every mother care, which can only be done by overcoming that trinity of evils—poverty, ignorance and indifference. Epictetus shrewdly observed: "Has another man's child died or his wife? Who is there will not say: 'It is the lot of humanity!' But when his own may die, then straightway it is: 'Alas; Wretched that I am!'"

Ashby's basic idea is to provide the means for careful study and sympathetic understanding before attempting alleviation. His object is achieved with a maximum of sound common sense combined with a minimum of non-essentials. Appended to each chapter are adequate references, offering suggestions for further reading. A reliable index gives a pleasing finish to a valuable book.

[1] "Infant Mortality," by Hugh T. Ashby, B.A., M.D., B.C. (Camb.), M.R.C.P. (London); Second Edition; 1922. Cambridge: At the University Press; Demy 8vo., pp. 224, with nine illustrations. Price: 15s. net.

University Intelligence.

THE UNIVERSITY OF SYDNEY.

A meeting of the Senate of the University of Sydney was held on October 9, 1922.

The degree of M.B. was conferred upon Messrs. A. W. Chalmers, C. J. A. de Monchaux, K. E. Hennessy, N. A. Lawler and A. E. Paterson and the degrees of M.B. and Ch.M. were conferred upon Messrs. R. C. Geeves, J. B. Gordon, A. L. Kinna, K. M. Locke, W. K. Manton, J. S. Reid and upon Miss Katharine Hyndes and on Miss Doris I. Swanwick *in absentia*.

It was decided to adopt the suggestion of the University of Melbourne that the Australian Universities should take joint action in the matter of obtaining exemption from payment of the Federal income tax on gifts to the University.

The following recommendations from the Linnean Society were noted:

(*a*) That the University authorities be informed of all appointments to Linnean Macleay Fellowships and notified that Fellows who desire to work in the University Laboratories undertake to conform to the regulations for research students drawn up by the University.

(*b*) That the Council ask the University for copies of reports furnished from time to time by heads of departments on the work of Fellows carrying out their researches in the laboratories of the University.

It was decided to grant the request contained in the second recommendation.

A suggested scheme for carrying out the syllabus of the post-graduate course in medicine, to begin on January 8, 1923, was adopted and referred to the University Extension Board for the purpose of carrying out the details.

The Medical Journal of Australia

SATURDAY, OCTOBER 28, 1922.

The Protection of Health.

It has become a platitude to refer to health as a national asset. At the recurrent rallies organized by a handful of enthusiasts public speakers habitually appeal to popular fancy by employing platitudes of this kind and habitually pause for the applause that follows. The prevention of disease is an economic and national problem of far greater importance and significance than is generally believed. Unfortunately it is easier to talk of these things than to carry them into effect. There is today throughout the world more disease and premature death than ever before and, notwithstanding the efforts of the International Health Committee of the League of Nations, of the great official health departments of the several nations and of the numerous private and quasi-private hygienic undertakings, the business-like application of the principles of preventive medicine remains a sort of isolated demonstration of the possibility of grasping opportunities to wage war on invisible foes and to emerge victorious through the agency of special weapons. This state of affairs is a reproach to the world claiming civilization. It involves an economic problem and a sociological one. No one hesitated in the year 1914 when the call was made to fight a powerful foe. Concerted effort was required and all classes and conditions of men lent their aid toward the achievement of the desired end. The Empire signed a blank cheque and is now endeavouring to find a business method of meeting the obligations. War meant concurrent sacrifice of life and frenzied effort to conserve health and to save life. The safety of the nation was at stake and in the circumstances the interests of individuals had to be ignored.

In the war against disease success depends on the same determination to see the thing through. It is necessary to sign the blank cheque. Business men must be shown that the immediate cost is of no importance. Disease means loss of wages, unemployment with an endless drain on the resources of the country, waste of potential production leading to increased cost of necessary commodities, loss of lives which, apart from all sentimental value, have a definite economic worth. There can be no doubt that a sensible nation will sign the blank cheque and will rely on sound organization and concerted effort to produce tangible results. War on disease means the enlistment of many sorts and conditions of man, each to play an important part. It may even be necessary to permit the war to interrupt for a time the ordinary affairs of life, so that, as the goal is reached, the level of production may be vastly increased.

The third annual report of the Ministry of Health of the United Kingdom contains an inventory of the activities which comprise the work of a governmental department charged with the preservation of the health of a nation. It is not our intention in this place to deal with this important report. That must be deferred for the present. Apart from the usual departmental administration of the health laws, including the central control of infective disease, the regulation of sanitary arrangements, the protection of the food of the community and the superintendence of housing conditions, the Ministry has under its purview the welfare of the blind, the coordinating work in connexion with voluntary hospitals, maternity and child welfare and many other hygienic activities and, lastly, the immense undertaking of the National Health Insurance. The number of persons insured in England alone exceeded 11,000,000 in 1921, which represents close on one-third of the entire population. The amount of money received in connexion with the insurance, including the sale of stamps to employers and employees, amounted to £31,144,194. The amount of money paid in benefits exceeded thirteen million pounds sterling, while nearly ten millions were paid to the medical profession and to institutions for medical treatment. Over twenty-four million pounds have to be spent in twelve months as the cost of the illness and accident affecting eleven million people. The whole or nearly the whole of this annual sum is unproductive and consequently a dead loss. It is necessary to add to this sum the amount

of money lost in wages or perhaps it would be better to have regard to the value of the work which the individuals would have completed had they escaped disease or accident. The extravagance of permitting disease to claim its victims year after year is evident and it is equally evident that a very large amount of money could be spent on well developed preventive schemes with financial advantage to the people.

Recently the Federal Treasurer, speaking in Melbourne at a Health Week meeting, maintained that if the imagination and the interest of the people could be stirred, it would be possible to do wonderful things in regard to national health. He deplored the wide-spread ignorance prevailing. He expressed the belief that a Ministry of Health would be established in the Commonwealth Government and that this Minister would be more important than any other Minister. Provided the money was well spent, he, the Federal Treasurer, held the opinion that no amount would be too great to expend to achieve the desired results. In the course of his remarks he referred to the fact that in the Australian constitution the States were primarily responsible for the control of health, save in regard to quarantine, the prevention of great epidemics and the payment of the maternity bonus. These utterances are highly significant. We have pointed out times without number that Australia is labouring under a grave disadvantage in that with a population of little more than five and a half million people there are seven health authorities, with six sets of health laws and six methods of administering these laws. The problems of preventive medicine are the same in all parts of the Commonwealth. Not long ago the Federal Committee of the British Medical Association in Australia strongly advocated the establishment of a Commonwealth Department of Health with a professional permanent head, under the control of a Minister of Public Health without other portfolio. The Committee recognized that until the States surrendered their sovereign rights in connexion with the control of the public health, the functions of this ministry would be to some extent limited. The Prime Minister foreshadowed this step in 1919 and even suggested that it might be necessary for the Commonwealth Government to assume complete control. Be this as it may, it would seem that the time has arrived when the Federal Department of Health should be placed under the charge of a Minister without other portfolio. The Federal Treasurer should be reminded from time to time of the blank cheque scheme. If preventive medicine is to be developed along proper lines, it will be necessary to coordinate all the hygienic forces that can be mustered. To attempt such a movement on the plan of the present six-State system would be to court failure. Place the campaign under one competent and responsible authority, demand that reasonable local autonomy shall be provided, emancipate the control of the health of the people from party politics and Australia will soon be leading the world in preventing disease. Whatever may happen in the near future in Federal political circles, it is to be hoped that the first place will be given to the subject of paramount importance, the war on disease.

PERI-ARTERITIS NODOSA.

In 1816 Kussmaul and Maier described a pathological condition characterized by aneurysmal swellings and nodular formation of the small arteries and accompanied by destructive tissue changes. To this disease the descriptive name of *peri-arteritis nodosa* was given. After the original description of the disease several other clinicians recorded their observations of the condition. Among the more noteworthy were Dickson, who in 1907 published a comprehensive monograph on the subject, and Klotz, who in 1917 added useful contributions to the knowledge of the matter.

The arteries of one part of the body may be affected to a much greater degree than those in other parts. It can thus be easily understood that the symptoms produced vary between wide limits and may present such a complex syndrome that diagnosis becomes a difficult problem. When the subcutaneous vessels are involved, the nodules become palpable. They are tender and, when excised, show such typical microscopical structure that diagnosis becomes possible. When there is no involvement of the subcutaneous vessels, diagnosis is seldom made *ante mortem*. The secondary tissue changes may be so extensive that it would be quite possible to overlook the primary arterial lesion in performing the *post mortem* examination, unless particular care were taken. The disease attacks the male sex more frequently than the female and, while it may apparently occur at any age, it is more common in adult life. The age of the youngest sufferer whose history is recorded, was two and a half years and that of the oldest fifty-seven. The onset is usually sudden and accompanied by fever and possibly rigors. Progressive wasting and anæmia, together with a leucocytosis, are gen-

erally present. Pain may be and usually is severe. The location of the pain and the nature of the accompanying symptoms depend on the area or system of the body most affected by the arterial changes. Thus, cramps and tenderness of the muscles may be prominent features; sensory changes may occur, while renal symptoms or abdominal colic and diarrhœa may be the chief cause of complaint by the patient.

A typical and highly instructive case has recently been studied and reported by Dr. William H. Harris and Dr. Andrew V. Friedrichs.[1] The patient was a coloured male labourer, twenty-two years of age. He was admitted to hospital complaining of weakness and pain in the abdomen. The family and previous histories of the patient contained nothing of importance, with the exception of an injury to the leg two years previously that had necessitated his admission to hospital. No indication of a syphilitic infection was obtained as the result of a Wassermann test made at that time.

The onset had been sudden and had occurred a week prior to admission. He had had pain in the epigastrium and in the lower part of the abdomen and had vomited in the early stages of the attack. Constipation had been present. Examination on admission failed to reveal anything more than tenderness in the region of the liver. The systolic blood pressure was one hundred and forty millimetres of mercury and the diastolic eighty.

A few days later hiccough developed. Pain became acute over the right kidney and vomiting occurred. A diagnosis of an acute abdominal condition was made. The patient became rapidly worse and died without any surgical interference having been undertaken.

At no period in the disease did the urine contain any abnormal constituents. A definite leucocytosis was present. On *post mortem* examination a large blood clot was found in the right kidney area. The gastro-epiploic artery was enlarged and tortuous. It was 23.5 centimetres in length. Sections through the dilatations showed them to be part of the vessel. In some a small lumen was found and in others an aneurysmal sac. Nodules were present on the branches of the coronary arteries. The most noticeable changes were found in the right kidney. Nodules were present in great numbers and from one aneurysmal dilatation an extensive hæmorrhage that had been the actual cause of death, had occurred.

In discussing the pathology of *peri-arteritis nodosa* Drs. Harris and Friedrichs point out that a better understanding of the process can be gained if the changes are studied in three groups or stages. In the first place, the primary lesion occurs in the arterial wall. Exudation and degenerative changes occur in the peri-adventitial structures, in the *tunica adventitia*, in the *tunica media* and very occasionally in the *tunica intima*. The degenerative changes are most common in the *tunica media*. The second group of changes is characterized by aneurysmal dilatations at the affected site, by hæmorrhagic extravasations and by infarction and thrombosis. The third group occurs as a result of cutting off the blood supply of an organ by thrombosis or by pressure from extravasated blood. Cloudy swelling, fatty degeneration, coagulation necrosis and so forth may be caused.

Drs. Harris and Friedrichs lay stress on the necessity of regarding these changes as part and parcel of the disease and they hold that a more correct understanding of the process will thus be gained. With this object in view they make the suggestion that the disease should be named *peri-arteritis nodosa aneurysma thrombotica*. The name may be somewhat cumbersome, but the suggestion is nevertheless a reasonable one.

In regard to the ætiology many diverse opinions have been expressed. Weichselbaum regarded the disease as a syphilitic manifestation. Schmorl and Benedict were inclined to the same opinion on account of the improvement that occurred in their patients after the administration of iodide of potassium. Benda thought that the vascular lesions bore no resemblance to those characteristic of vascular syphilis. Dickson held that two distinct conditions were described under the term *peri-arteritis nodosa*. The one he called *peri-arteritis nodosa* and regarded it as a true peri-arteritis due in nearly all instances to syphilis. The other he called *poly-arteritis acuta nodosa* and described it as being characterized by the formation of small, localized nodules on the smaller and medium sized arteries.

Drs. Harris and Friedrichs point out that the rarity of the occurrence of *peri-arteritis nodosa*, when taken into account with the frequency of syphilitic vascular lesions, the failure to find the *Spirochæta pallida* in the nodules, the absence of a reaction to the Wassermann test and the actual histo-pathology of the lesions are relatively conclusive reasons for the elimination of syphilis as a cause. They refer to the fact that Lamb and Klotz were both unable to recover any bacteria from the blood of affected patients. Cultures obtained *post mortem* showed the presence of several different organisms in the investigations made by both these observers. When injected into animals, however, these organisms failed to produce a *peri-arteritis nodosa*. Drs. Harris and Friedrichs prepared an emulsion from the nodular kidney lesions of the patient reported and injected it into rabbits. In this way they succeeded in producing lesions of all three groups as described by them. The most typical lesions were produced by injecting into a rabbit a Berkefeld filtrate of an emulsion prepared from the organs of a rabbit injected with the human emulsion. From these results they conclude that the causative agent is a filter passer from which no apparent growth can be obtained by any of the known methods. They further suggest, in view of the occurrence of a similar, if not identical, disease in animals, that one of the lower animals may represent the natural habitat of the disease and that, as in actinomycosis and glanders, man is only occasionally infected. This point of view is interesting, but it will require more investigation and experiment before it can be regarded as proven. The work as set forth by these two observers throws new light on a rare but none the less important condition,

[1] *The Journal of Medical Research*, June-July, 1922.

Abstracts from Current Medical Literature.

MORPHOLOGY.

Ligature of the Thoracic Duct.

FERDINAND C. LEE (*Bulletin of the Johns Hopkins Hospital*, January, 1922) reviews the literature concerning experimental ligation of the thoracic duct and then proceeds to outline his own methods and results, more especially as regards the types of collateral circulation which may become established. As early as the year 1791 Flandrin, a veterinary surgeon, successfully ligated the thoracic duct in horses. Nearly all these animals survived. Since then various views have been held as to the results of ligature of the duct. Some observers found that their animals died. It gradually became clear that in many animals the thoracic duct opened into the veins on both sides of the neck and that there were several alternative paths whereby the lymph could reach the veins. The author's work was wholly performed on the cat. Instead of operating on the duct in the neck, the author adopted a new method. He tied the duct low down in the chest, by operating from the back through the ribs. When studying the results at varying intervals after the operation, the mesenteric lymphatics were injected under ether anæsthesia with a saturated aqueous solution of Berlin blue. Two types of collateral circulation were observed. In one the lymph tracked across to the right thoracic duct and in the other the lymph entered the azygos vein or its branches. It was also observed that an œdema developed round the *cisterna chyli* and its large trunks, varying in nature from a chylus type to a limpid, slightly yellow-tinged clear fluid. The lymph glands also underwent definite hypertrophy. Retrograde injection of lymphatics was frequently observed when injecting the Berlin blue, indicating an inefficiency of the lymphatic valves. As a result of his experiments, the author concludes that the duct may be ligated without great disturbance or death resulting.

Taste Fibres and the Chorda Tympani Nerve.

J. M. D. OLMSTED (*Journal of Comparative Neurology*, June 15, 1922) records further investigations on the relationship of taste fibres to the *chorda tympani* nerve. The presence of taste fibres has been demonstrated in several ways. In the first place, it has been shown that loss of the sense of taste occurs in the anterior part of the tongue after injury or severance of the nerve. Secondly, an instance has been recorded in which sensations of taste were aroused in a patient by direct stimulation of the *chorda tympani*. In has also been shown that taste buds disappear from the circumvallate papillæ on section of the glossopharyngeal nerve and from the fungiform papillæ of the anterior part of the tongue on section of the lingual nerve. These taste buds disintegrate and are removed by phagocytes within eight days after cutting the nerves. The writer shows that this change in the taste buds in the fungiform papillæ is due to included fibres of the *chorda tympani* nerve. He points out that severance of the lingual nerve proximal to the entrance of the *chorda tympani* gives rise to no change, whereas in two instances division of the *chorda tympani* itself without injury to the lingual nerve was followed by the disintegration of the taste buds of the fungiform papillæ.

Congenital Elevation of the Scapula.

M. DELCHEF (*Bulletin de l'Académie Royale de Médecine de Belgique*, May 27, 1922), writing on "Congenital Elevation of the Scapula," defines the position of the normal scapula as lying between the first rib space and the seventh space or as low as the eighth rib. Any elevation above this may be single or bilateral, congenital or acquired. The author states that two English writers, Willett and Walsham, reported an instance of this condition in 1880, eleven years before it was described by Sprengel, of Dresden, after whom it is usually named. The same two authors described in 1883 an operation attempted by them to relieve the condition in a child eight years old by excising the bony connexion with the vertebral column which is often present. The author points out that the scapula may be normal in shape, but usually tends to approach the embryonic type, with its longest axis along the spine. At the same time it is usually reduced in size. Further, the superior angle may be bent to an excessive degree and drawn out into what would at first sight appear to be an exostosis. The whole bone is displaced towards the neck and forwards on to the chest. There is a tendency to rotation, so that the inferior angle approaches the vertebral spines. There is frequently an associated abnormality of the vertebral column, such as scoliosis, absence of vertebra or irregularly formed vertebræ. The ribs may be abnormal and the presence of cervical ribs is by no means uncommon. Supernumerary bones may be present in the form of bony bars uniting the vertebral border to the spines of the vertebræ. These arise most frequently from the superior angle of the scapula and are generally attached to the seventh cervical spine, but may reach to the spine of the atlas and may also gain attachment to the transverse processes. The author gives an account of the physical examination of such instances in the living subject and discusses the various theories put forward to explain the condition. Tridon believed that it was due to a failure of the scapula to migrate back from its embryonic cervical to its adult thoracic position. The union with the vertebræ is considered to be only a complication and not the cause of the condition. The author considers operative treatment to be comparatively useless, except to give some greater freedom of movement, and states that on the other hand it may be advisable to fix the scapula. In conclusion, he suggests the term "*ectopic scapulaire*" as being the most suitable to apply to the condition. A bibliography of seventy-one references is appended.

The Structural Type of the Mastoid Process.

BASED upon the skiagraphic examination of one thousand crania of various races of mankind, A. LOGAN TURNER AND W. G. PORTER (*Journal of Laryngology and Otology*, March and April, 1922) have recorded the following conclusions: In the skiagram of the skull it is possible to recognize the cellular and acellular types of mastoid process. When non-stereoscopic pictures are used, it is not always possible to give a correct interpretation of what is seen in the living head. In European skulls an average of 80% of the mastoids are pneumatic. Anatomical asymmetry of the mastoid process in individual skulls occurred in 12% of a series of one thousand crania. The asymmetry is usually due to a cellular process on one side and an acellular process on the other; in the remainder both processes are cellular, but the cells are unequally distributed. Clinical asymmetry is found in only 7% or 8% of the skulls. The relative frequency of the occurrence of the two types of mastoid process and the incidence of asymmetrical development is virtually the same in both male and female crania. The cellular and acellular mastoid processes occur generally in dolichocephalic, brachycephalic and mesaticephalic skull-forms in a definite relationship, the percentage of cellular processes being lowest in the dolichocephalic, highest in the brachycephalic, while they occupy an intermediate position in the mesaticephalic. The reverse is true of the acellular processes. There may be certain racial exceptions, *e.g.*, in the Eskimo, Melanesian and Polynesian crania. In these the cellular processes greatly predominate, irrespective of the type of skull. There is a higher percentage of cellular mastoid processes in the long- and short-headed crania of the relatively pure races than in the same types of skull in the mixed European peoples. Furthermore, the frontal sinus, like the cellular mastoid process, is found more often in brachycephalic than in dolichocephalic crania. It occurs more frequently, is more spacious in the crania of the mixed European peoples than in the crania of the relatively pure races and in this respect differs from the incidence of the cellular mastoid. There is no evidence, either in individual skulls or in groups of skulls, that the frontal sinus and the cellular mastoid spaces attain a similar degree of development. In no group of skulls can the development of the frontal sinuses be regarded as assuming a racial characteristic such as the cellular mastoid process appears to acquire in the dolichocephalic Melanesian and the brachycephalic Polynesian crania.

ORTHOPÆDIC SURGERY.

Transplantation of Fascia and Tendon.

W. E. Gallic and A. B. Le Mesurier (*Journal of Bone and Joint Surgery*, July, 1922) investigated the process of simple healing of the fibrous tissues of the body. Experiments were performed in which transverse and longitudinal excisions were made in fascia, tendon and aponeurosis and closed with absorbable and non-absorbable sutures. The specimens were recovered at weekly intervals up to several months. It was found that the process of repair was at its height at the end of two weeks and that in the repair the tendon cells and fibres took little or no part. Connective tissue cells derived from the areolar membranes on the surface of the fibrous tissue proliferated to form ordinary connective tissue in the line of the incision. This is held to explain the uncertainty that attends the healing of tendons after subcutaneous tenotomy and the frequency with which the abdominal aponeuroses separate after edge-to-edge suture in ventral hernia. The tendency to separate was reduced considerably by overlapping the edges of the incised fascia or aponeurosis and by making a step tenotomy in the case of tendon. For the overlapping method to be effective it was found that the surfaces placed in contact must be completely deprived of their sheaths of areolar tissue. The implantation of one tendon into another was best accomplished by passing the split end of one tendon into an incision in the other or by actually weaving them together. The healing of tendon to bone was brought about by the formation of fibrous tissue which adhered to both. This fact is regarded as explanatory of the unsatisfactory results following fixation of a transplanted tendon to periosteum or to a short groove in a bone. The authors state that the only safe method of fixation consists in passing the scraped or split end of the tendon through a bole in the bone. Experiments in the healing of transplanted fibrous tissue confirmed the results of previous investigations showing that transplanted fascia, tendon or aponeurosis continues to live practically unchanged. If the transplanted tendon is thick, the centre will degenerate and this indicates that such a transplant should be split or incised to allow lymph to reach the deeper parts. The transplanted tissues heal by formation of new connective tissue, but the method of healing is just as unreliable as when fibrous tissues are closed by simple suture. The difficulty can be overcome by using living sutures of fibrous tissue. The sutures remain living and become incorporated with the tissues into which they are inserted. In clinical practice the sutures are prepared from *fascia lata* and are threaded through a needle with a large eye. The suturing is done as with other suture materials, but there are certain details in technique necessary to get a satisfactory result. A number of operations are described illustrating the use of fibrous tissue transplants and living fibrous tissue sutures.

Lengthening of the Quadriceps Tendon.

George E. Bennett (*Journal of Bone and Joint Surgery*, April, 1922) draws attention to the factors causing limitation of movement at the knee joint and to the results he has obtained by lengthening of the tendon of the *quadriceps femoris*. The relationship between the four components of the quadriceps is so intimate that the *vastus intermedius*, lying on the anterior aspect of the femur, can render the action on the other three members of the groups useless should it become involved in adhesions. The changes within the knee joint in the presence of limitation of movement are variable. There is a certain amount of obliteration of the quadriceps pouch, but capsular changes are small and do not present an obstacle to movement after the tendon has been lengthened. The author describes in detail eight instances where this operation was necessary. When performing the operation the patient is placed on the operating table with the leg extending over the end so as to allow freedom of movement. A median incision extending from the middle of the patella to the junction of the middle and lower thirds of the thigh exposes the quadriceps tendon. The tendon is then cut free from its muscular attachments by a linear incision on each side. A short transverse incision connects these two longitudinal incisions at the point where the tendon of the *rectus femoris* begins and the whole tendon is dissected from the underlying structures. The knee is then flexed carefully to 90° and any adherent points in the capsule or about the lateral margin of the knee are cut. The tendon is again attached to its muscle with the knee in a position of 80° of flexion. In the presence of definite adhesions in the lower portion of the thigh it may be necessary to dissect the *vastus* muscles free from the femur, permitting them to be drawn towards the middle line and attached to the tendon. The full return of power and range of movement is not to be expected under twelve months from the time of operation.

Manus Planus.

Joel E. Goldthwait (*Journal of Bone and Joint Surgery*, July, 1922) draws attention to the disabilities associated with the deformity known as flat hand. The hand in repose is concave, both longitudinally and laterally. The bones of the carpus are arranged in a definite transverse arch and the first row of carpal bones is also arched towards the palm. On this arrangement depends the effective use of the fingers. When the fingers are extended with the arch preserved, they spread out in fan shape, following the direction of the metacarpal bones. When the fingers flex they draw towards the median line. The convergence of the finger tips to a common point is absolutely essential to the delicate use of the hands and is impossible unless the carpal arch is preserved. The maintenance of the carpal arches depends upon the muscles and ligaments. The tendons of the long muscles which flex the fingers and thumb obtain leverage from a well formed carpal arch. If the arches are flattened, the effectivity of the muscular contraction is lessened and the muscles themselves in their continuation tend to flatten this arch still further. When such a condition exists, treatment is directed towards restoring the bones to their proper position and improving the tone of the muscles and ligaments to maintain this position. A mechanical support is described for use when the deformity is slight. When the deformity is severe, it may be necessary to manipulate the bones into position and to hold them in fixed dressings for a time.

Recurrent Dislocation of the Patella.

W. R. MacAusland and A. F. Sargent (*Surgery, Gynecology and Obstetrics*, July, 1922) report sixteen cases of dislocation of the patella. The causes of the condition are discussed and the greatest importance is given to lateral displacement of the patellar tendon and to imperfect development of the lateral condyle of the femur. In a recent attack the condition is treated by reducing the dislocation and immobilizing the limb in plaster of Paris for three weeks. In recurrent attacks treatment consists of supportive and stimulative measures, the correction of static errors and operative procedures. The operative treatment which yielded the most satisfactory results was transplantation of the medial half of the bony attachment of the patellar tendon to a more medial position. The patellar tendon was split to allow this to be done. Fixation in plaster of Paris for ten weeks was followed by massage and movements.

Hypertrophy of the Patella.

George E. Bennett (*Journal of Bone and Joint Surgery*, July, 1922) has devised an operation for reducing an hypertrophied patella to its normal size. Hypertrophy of the patella often follows a comminuted fracture or vigorous manipulation of the knee. Osteomyelitis or severe strains may also be a cause. Loss of function, particularly the inability to flex the leg without pain and discomfort when attempting to walk up or down gradients, is an indication for operation. The actual operation is planned as follows: The patella is exposed by a linear incision and the section to be removed is marked out with a scalpel. The bone is cut longitudinally for three-fourths of its depth with a thin saw and then cracked with an osteotome. Heavy kangaroo tendon is used to unite the edges of the patellar and quadriceps tendons, while chromicized catgut is used to close the fascia over the patella. No suture is put through the patella. The operation has been used for several years and is satisfactory.

British Medical Association News.

SCIENTIFIC.

A MEETING of the New South Wales Branch of the British Medical Association was held at the Coast Hospital on September 8, 1922, the President, DR. T. W. LIPSCOMB, in the chair. The following patients were shown by DR. R. J. MILLARD and his staff:

Aneurysm of the Ascending Aorta.

A male patient, aged fifty-five years, had been admitted to hospital on May 25 with a history of having suffered from shortness of breath, abdominal pain and pain in the precordial area extending up to the right shoulder for one week previously. He had had similar attacks in 1921 and 1919. Physical examination upon admission had shown the patient to be breathless and of a greyish complexion. The apex heart beat had been in the fifth intercostal space. A thrill had been felt over this area. On percussion there had been dulness at the upper part of the right border of the sternum for nearly 3.75 centimetres (one and a half inches) to the right. The cardiac dulness had extended for fifteen centimetres (six inches) to the left of the middle line. On auscultation a loud to and fro murmur had been heard at the aortic area. The liver dulness had extended from the sixth rib to five centimetres below the costal margin. There had been no pupil nor laryngeal involvement. The patient's blood serum had not reacted to the Wassermann test. Skiagraphic examination at the Sydney Hospital had shown the presence of an aneurysm of the ascending aorta.

Hæmatomyelia.

A male patient, aged forty-nine years, had been admitted to hospital on April 12, 1922, with a diagnosis of alcoholic neuritis. He had been quite well until four days before admission, when he had collapsed on getting out of bed. He had not become unconscious, but had been unable to move either his arms or his legs. This had been followed by a tingling sensation in the limbs and by inability to pass urine. He had been catheterized for four days and had given no history of venereal disease. On examination the patient had had wrist-drop and spasticity of the arms and legs. The pupils had been small, but equal and had reacted to light and accommodation. The knee jerks had been greatly exaggerated and double patella and ankle clonus had been present in addition to a double Babinski reflex. The abdominal muscles had been in a state of spasticity. The patient's cerebro-spinal fluid had not reacted to the Wassermann test. After admission the condition of spasticity had increased and at the time of the demonstration there was definite wasting of the interossei muscles of the hands, also of the thenar and hypothenar eminences. The muscles of the forearm and shoulder were also wasted. The patient's legs were adducted and he was liable to sudden attacks of cramp and pain in the legs. A diagnosis of hæmatomyelia had been made and it was thought that the lesion was probably situated at the cervical enlargement, involving chiefly the lateral columns, but also certain anterior horn cells.

General Paralysis of the Insane.

A female patient, married, aged forty-nine years, had been admitted to hospital on July 6, 1922, with a normal temperature and a pulse of 120. Her husband had dated the onset of the illness from a convulsive seizure which had occurred eighteen months previously after witnessing an accident. She had been admitted to the Sydney Hospital at that time and had been treated for fits. In April, 1922, she had been an inmate of the South Sydney Hospital for the same complaint. Since leaving the latter institution she had had no more fits. Lately, however, she had become forgetful of time and place and had lost the use of her limbs and the control of the sphincters of the bladder and rectum. On admission to the Coast Hospital the patient had been roused with difficulty and had answered questions in a contradictory and altogether unreliable manner. She had been unable to concentrate her thoughts even for a few seconds. Her voice had been monotonous and speech slurred and slow. She had complained constantly of headache and great thirst. She had lain on her back with her feet fully extended. The arms had been flexed across the thorax. The limbs had been very spastic and no wasting had been present. The pupils had reacted to light and accommodation. All the reflexes had been exaggerated. Oppenheim's and Babinski's phenomena had both been present. There had been no ankle or patellar clonus and no alteration in sensation. The blood serum had not reacted to the Wassermann test, but the pathologist had reported that the test as applied to the cerebro-spinal fluid, had shown "hampering of reaction." Treatment had been by iodide of potassium, 0.6 gramme (ten grains) having been given three times a day. The dosage had been increased up to 2.1 grammes (thirty-five grains) three times a day by adding 0.3 gramme every fourth day. At the time of demonstration there had been considerable improvement. The patient was taking an interest in her surroundings, but her memory was not good. She could not remember whether her age was ninety-seven, twenty-nine or forty-nine. The spasticity had almost disappeared and she had begun to walk.

A male, aged twenty-four years, had been admitted to hospital on August 23, 1922, complaining of difficulty of speech for a previous period of six months. At the onset of the trouble he had occasionally had difficulty in articulating clearly for about half an hour. His speech had then been normal for a week or two. He had had no previous illnesses and had been a letter carrier in the postal service. On admission to hospital his speech had been drawling and hesitant. His memory had been unimpaired. He had appeared to be perfectly contented and had stated that he had made a great deal of money at letter carrying (his wife had admitted his dismissal from the Postal Department for inefficiency). There had been no motor impairment and no sensory phenomena. The Argyll-Robertson pupil had been present. The Babinski phenomenon had been manifested on the right side. There had been no Rhombergism or incoordination of movements. Both the blood serum and the cerebro-spinal fluid had yielded a reaction to the Wassermann test. In treatment diarsenol (0.4 gramme) had been given intravenously. This had been followed by lumbar puncture on two occasions, when cerebro-spinal fluid had been withdrawn under increased pressure. Mercury and potassium iodide had been administered by mouth. At the time of demonstration there was no appreciable change in the patient's condition.

Leprosy.

A male patient, aged thirty-three years, had been born in New South Wales and had never been out of the State. He had been a patient at the Coast Hospital, suffering from the disease, for twenty years.

A second male patient, aged fifty-eight years, had suffered from the disease for eleven years. He had contracted it in India.

A third patient, a Chinaman, had been suffering from the disease for two and a half years and showed the typical leonine face.

A fourth male patient, aged eighteen years, born in New South Wales, had suffered from the disease for six years.

Various forms of the skin lesions as typified in these patients were demonstrated. The treatment used consisted of the administration of capsules of chaulmoogra oil. Each capsule contained one cubic centimetre (fifteen minims) of the oil. As much as eight and a half cubic centimetres (one hundred and thirty minims) were sometimes administered *per diem*, but the average quantity taken by each patient was six cubic centimetres.

The use of gynocardate of magnesium was generally combined with that of chaulmoogra oil, though some patients were unable to take it.

Latterly the esters of chaulmoogra oil had been injected intramuscularly in doses of three cubic centimetres. Trial had recently been made of colloidal antimony, known as "*oscol stibium*." After eight months' constant administration no improvement had been noted and its use had been discontinued.

Pityriasis Rubra Pilaris.

A male patient, aged forty-four years, had been admitted to hospital as suffering from arsenical dermatitis. The

condition had been present for six months and, according to the patient, had followed the use of an arsenical sheep dip. The patient had been seen by Dr. McMurray, who had diagnosed the condition as *pityriasis rubra pilaris*. Dr. McMurray had drawn attention to the peculiar papules present on the epigastrium. In other regions the papules had coalesced to form red plaques resembling psoriasis. Treatment used had been rest in bed combined with the administration of an effervescing quinine mixture and the use of Hebra's ointment. No baths had been allowed to the patient. At the time of demonstration improvement had taken place.

Pyo-Pneumothorax.

A female patient, aged fourteen years, an enamel worker, had been admitted to hospital on May 23 with a history of having been ill for eleven days with vomiting, cough and pain in the left side of the chest on coughing. The patient had fainted the day before admission on being moved from bed. Dyspnœa had only occurred on coughing. The patient had worked in dusty surroundings as an enameller. Examination on admission had failed to reveal the presence of an apex beat, but there had been a visible pulsation to the right of the sternum. The heart sounds had been loudest in this area. The left side of the chest had moved much less freely than the right. The breath sounds had been quite absent on the left side, but the presence of a metallic coin sound had suggested that the patient was suffering from a pneumothorax. The sputum had been purulent and offensive. The temperature chart had shown fever of a hectic type. Examination of the sputum had shown the presence of some pneumococci and streptococci. Tubercle bacilli had not been present. Exploration of the left side of the chest with a needle had yielded merely a little blood. The condition had remained unaltered for three weeks and subsequently the breath sounds had returned slowly, but had been cavernous in type, with ægophany. A splashing sound had been present on deep inspiration. Repeated examination of the sputum had failed to disclose the presence of tubercle bacilli. An autogenous vaccine had been prepared and doses of up to three hundred million organisms had been given. The signs had gradually cleared up and at the time of demonstration the chart had shown the patient to have been afebrile for two weeks. The patient was up, had no sputum and the apex beat was present at a point 3.75 centimetres (three and a half inches) to the left of the middle line. The condition had been regarded as that of a primary abscess bursting into the pleural cavity and causing pyo-pneumothorax. No X-ray examination had been undertaken.

Pneumococcal Arthritis.

A female patient, married, aged thirty-one years, had been admitted to hospital on July 21, 1922, suffering from double pneumonia and with a history of having been ill for seven days. She had been cyanosed and her condition had appeared very grave. Sixty cubic centimetres of anti-pneumococcal serum had been given. The patient's temperature chart had subsequently been of a septic type and great distension of the abdomen had been present. On July 30 a painful swelling had been found in the left knee, due to the distension of the supra-patellar bursa and also on the lateral aspect of the left ankle. From the former pus containing pneumococci had been aspirated. On August 5 the patient had developed a crop of vesicles on the mucous membrane of the lips, soft palate and tongue. These had broken down and ulcerated. From one of the vesicles pneumococci had been grown. On August 8 the knee had been aspirated and ninety cubic centimetres (three ounces) of pus had been withdrawn. The knee had subsequently been aspirated a second time and one hundred and twenty cubic centimetres of pus withdrawn. On August 20 the subdeltoid bursa had become swollen and on exploration had yielded pus. From this pus a pure growth of pneumococci had been obtained on culture. At the time of demonstration the pneumonia had cleared up, the bursitis was being treated by repeated aspiration, an autogenous vaccine was being used and the patient's condition was improving.

Post-Diphtheritic Neuritis.

A male patient, aged thirty-nine years, had been admitted to hospital on August 1, 1922. He had given a history of "influenza" and what had been diagnosed as tonsillitis two and a half months earlier. He had been away from his work for five weeks. Two weeks before admission to hospital he had had to cease work again on account of numbness and increasing weakness in the arms and legs. The Klebs-Löffler bacillus had been found in his fauces at the Royal Prince Alfred Hospital on July 31. There had been no history of alcoholic excess. Examination on admission to hospital had shown all the cranial nerves to be intact. The knee jerks had been absent. There had been paresis of the muscles of the arms and hands. This had been more noticeable in the extensor muscles. There had been impaired sensation over the fourth and fifth fingers, indicating involvement of the seventh cervical nerve root. At the time of demonstration he had improved considerably as a result of rest and massage. It was supposed that the original attack of tonsillitis had been due to the Klebs-Löffler bacillus and that the present condition of peripheral neuritis was post-diphtheritic in character.

Tabes Dorsalis.

A male patient, aged fifty-one years, a wharf-labourer, had been admitted to hospital on August 13, 1922, with a history of having been ill for twelve months. At the onset of his illness he had been seized with giddiness, pain in the left hypochondrium and vomiting. The first attack had lasted for one day. Since that time he had had recurrent attacks of a similar nature at intervals of about two months and always associated with severe constipation. During an attack the pain had always begun in the left hypochondrium. The pain had been relieved by vomiting. There had been no nausea. There had been a history of syphilis thirty years previously. For the previous twelve months he had occasionally had difficulty in commencing micturition. He had had decreased sexual desire, lightning pains in the hands and feet and loss of weight. Rhombergism had been present, but no numbness. Examination on admittance had shown the pupils to be irregular with an absence of reaction to light. There had been no diplopia. All the other cranial nerves had been intact and there had been no impairment either of sensation or power of movement. The elbow, wrist, abdominal and cremasteric reflexes had been exaggerated. The anal reflex and the knee jerks had been absent. Neither the Babinski nor Oppenheimer phenomena had been present. A reaction had been obtained by the ordinary and ice-box methods of performing the Wassermann test in both the blood serum and the cerebro-spinal fluid. The condition had been diagnosed as *tabes dorsalis* of syphilitic origin accompanied by gastric crises.

A male patient, aged forty-two years, had been admitted to hospital on July 26, 1922, with a diagnosis of chronic gastritis. He had been ailing for one week with vomiting and diarrhœa. The vomiting had occurred within half an hour of the ingestion of food, had not been accompanied by pain, but had been preceded by nausea. This had been but one of the numerous attacks that the patient had suffered at intervals of about two months since 1916. He had given a history of Rhombergism, lightning pains in the legs, anæsthesia of the feet, waning sexual desire and a slowness in commencing micturition. Examination on admission had shown the pupils to be myotic and equal. They had barely reacted to light and accommodation. From the suprasternal notch extending all round the thorax and down as far as the umbilicus he had had alternate bands of anæsthesia and normal sensation two and and a half centimetres in width. He had had anæsthesia of the ulnar borders of the forearms and of the peroneal borders of the legs (Biernachi's sign). The ankle reflex and the knee jerks had been absent. Examination of the blood and cerebro-spinal fluid by the ordinary and ice-box methods of the Wassermann test had yielded a reaction in every instance. Two days after admission to hospital the patient had passed three hundred cubic centimetres (half a pint) of almost pure blood *per rectum*. A diagnosis of *tabes dorsalis* accompanied by gastric and intestinal crises had been made.

A male patient, aged thirty-eight years, had been admitted to hospital on August 18, 1922, with a history of having been ill for the previous thirteen months. The patient had described the onset of the illness as being due to "influenza," followed in ten days by palpitation of the heart. He had suffered attacks of pain in the hypo-

gastrium, shooting into the left thigh, the left testis and the left lumbar region. The pain had had no relation to food and had been relieved by flatulence or the passing of flatus. He had vomited several times while the pain had been present. He had had no hæmaturia, but on one occasion had passed blood *per rectum*. He had had recurrent attacks at intervals and coming on with great suddenness. Inquiry into his previous illnesses had failed to elicit a history of venereal disease. He had occasionally had shooting and stabbing pains in the legs. He had numbness of the feet and had complained of feeling unsteady on his feet in the dark and of loss of sexual desire. Examination on admission had shown the pupils to be equal and reacting sluggishly to both light and accommodation. All the cranial nerves had been normal. The epicritic sensation had been slightly impaired; he had had difficulty in differentiating between sharp and blunt points and between heat and cold when applied to the ulnar surface of the forearm and the peroneal borders of the leg. All the reflexes, including the knee jerks, had been present. A microscopical examination of the urine after an attack of pain had revealed the presence of red blood corpuscles. The blood serum, when subjected to the Wassermann test, had failed to yield a reaction in the ordinary method, but had reacted to the ice-box method. The cerebro-spinal fluid had shown some "hampering of reaction" when subjected to the Wassermann test in the ordinary way, but had yielded a definite reaction with the ice-box method. A skiagram of the renal tracts had failed to reveal a calculus. On August 31, 1922, he had passed five small calculi *per urethram*. They had been found on microscopical examination to consist of calcium oxalate and phosphate crystals. The urinary deposit had contained crystals of calcium oxalate. The condition had been diagnosed as being due either to *tabes dorsalis* with renal crises, to renal calculi alone or to a combination of both conditions.

Pernicious Anæmia.

A female patient, aged thirty-nine years, had been admitted to hospital on July 14, 1922, with a history of having felt ill for the preceding nine months after having been "poisoned by eating prawns." The patient had suffered habitually from constipation. For three weeks prior to admission she had been feeling very weak and for two weeks had been confined to her bed. She had complained of sharp shooting pains in the back and on each side of her abdomen. She had vomited greenish fluid on four occasions and this had relieved her pains. The stools had been very yellow and the bowels had been freely opened for three weeks prior to her admission. She had had headache and shivering fits and had often been breathless and complained of pain in the precordial regions. Examination on admission had shown her to be a very anæmic woman with a slightly greenish colour in her skin. The tongue had been red, flat, moist and a little cracked and sore. The palate had been pale and she had had very few teeth. She had stated that she had chewed her food with her gums for twelve years. Examination of the lungs had failed to reveal any abnormality and the apex beat of the heart had been in the fourth intercostal space inside the nipple line; the first sound had been accentuated at the apex. A blood count made three days after admission had shown the number of red cells to be 1,300,000; leucocytes, 5,000; and hæmoglobin value, 40%. There had been no nucleated red cells and no punctate basophilia. On July 25 the red cells had numbered 1,025,000, the leucocytes 4,300 and the hæmoglobin value had been 40%. The red cells had been very irregular in outline and anisocytosis had been present. No nucleated red cells had been seen. On August 23 and on August 30 0.3 gramme of diarsenol had been given intravenously. On September 6 the red cells had numbered 1,083,000 and the leucocytes 4,400. The hæmoglobin value had been from 50% to 60%. Anisocytosis, poikilocytosis and puncture basophilia had been present. No nucleated red cells had been seen.

A male patient, aged fifty-three years, had been admitted to hospital on June 12, 1922. The patient had complained of an increasing feeling of exhaustion and shortness of breath during the previous six months. For two weeks prior to admission he had suffered from dull and intermittent epigastric pain. The patient had expectorated blood every day for one month up to three weeks before admission. Examination had revealed a pale and flabby tongue covered with a moist fur. The teeth had been septic and there had been no loss of weight. Although the patient had complained of soreness in the epigastrium, no tenderness, rigidity nor tumour had been found. The edge of the spleen had been palpable. The lungs had been emphysematous and the apex beat of the heart had been situated in the fifth intercostal space within the nipple line. The heart sounds had been distant and there had been a systolic murmur audible in the pulmonary area and extending down the left side of the sternum to the mitral area. A venous hum had been audible at the base of the neck. A blood count made on admission had shown the erythrocytes to be 1,700,000, leucocytes 6,800 and the hæmoglobin value 40%. Poikilocytosis, anisocytosis and punctate basophilia had been present. No nucleated red cells had been seen. On August 9 the erythrocytes had been 1,625,000, leucocytes 5,700 and the hæmoglobin value 50%. Several megaloblasts and one normoblast had been found. The red cells had been irregular in size and shape and poikilocytosis and punctate basophilia had been present. On September 5 the erythrocytes had numbered 1,380,000, the leucocytes 5,000 and the hæmoglobin value had been 60%. Punctate basophilia and poikilocytosis had been present. Three normoblasts and several microcytes had been seen.

Septic Wound of Leg.

A male patient, thirty years of age, had been admitted to hospital on August 2, 1922, with a history of having been gored by a boar on that day. There had been an extensive laceration of the anterior compartment of the left leg. The wound had been twenty centimetres (eight inches) in length. Sepsis had occurred and treatment by continuous irrigation with Dakin's fluid through Carrel-Dakin's tubes had been undertaken. It had later become necessary to excise gangrenous tissue. The leg had been treated by means of a "eusol" bath and the condition had gradually improved.

Disseminated Sclerosis.

A female patient had been admitted to hospital on June 8, 1922, with a history of having begun to feel weak, with a swimming feeling in her head, fifteen months previously. Soon after admission to hospital she had developed a left-sided paresis of the face, a squint in the left eye and weakness of the left leg. These symptoms had all cleared up after a lumbar puncture. Since that time the patient had become worse and at the time of demonstration showed intention tremor and lateral nystagmus. Exaggerated reflexes were present. No sensory changes had been found. Speech was hesitating in character and the patient had very poor sphincter control.

Cerebral Syphilis.

A female patient, aged thirty-two years, had been admitted to hospital on June 27, 1922, complaining that she had that afternoon had a sudden and very severe pain in the right side of the head. She had not become unconscious and had subsequently been able to walk. On admission she had been drowsy and had resented examination and interrogation. Examination of the nervous system had shown paralysis of the lower portion of the left side of the face. The tongue had been deviated to the left. There had been no paralysis of the eye muscles. The pupils had been equal and had reacted to light and accommodation. There had been paresis of the left arm and leg. There had been no interference with sensation. The knee jerks and plantar reflexes had been normal. Examination of the heart had revealed a to and fro murmur at the aortic area. The patient had given no history of rheumatic fever, but had had one previous attack similar to that for which she had been admitted. This had occurred three weeks previously and had lasted for two hours. The Wassermann test as applied to both the serum and the cerebro-spinal fluid had failed to yield a reaction. After several days during which she had been drowsy, the patient had developed a left-sided hemiplegia. She had been given potassium iodide and Hutchinson's pill and at the time of demonstration was improving. A diagnosis of cerebral syphilis had been made and it was pointed out that the

occurrence of aortic disease and the subsequent development of a lesion of the central nervous system in a young woman who gave no history of rheumatic fever, pointed very strongly to syphilis.

Gonococcal Endocarditis.

A male patient, thirty-two years of age, had been admitted to hospital on May 30, 1922, complaining of shortness of breath, headache and pains behind the eyes. He had previously been a shop assistant, but for the preceding three months had been unable to work and had become an invalid pensioner. He had had broncho-pneumonia, measles and scarlet fever as a child and rheumatic fever thirteen years ago. He had given a history of having contracted gonorrhœa eight years previously and of having had a relapse twelve months prior to admission. He had been treated for heart trouble in the Royal Prince Alfred and in the Lidcombe Hospitals in 1915 and 1919 respectively. The patient had stated that he had not been really well since his attack of rheumatic fever, but that for the previous two and a half years he had been troubled with shortness of breath, palpitation and pain in the left axilla on exertion. He had experienced tightness in the chest and had had a troublesome cough with much viscid sputum. Twelve days prior to admission he had been taken ill in a tram, had felt faint and had vomited. He had recovered from this attack in a couple of hours, but from that time until his admission headache and pain behind the eyes had been continuous. He had been unable to read or to keep his eyes open in a bright light. He had no œdema of the feet, but had had night sweats. He had stated that he had been gradually losing weight. His appetite had been poor, though he slept moderately well. The bowels had been opened regularly and he had had no hæmoptysis. Examination on admission had shown him to be pale and obviously very ill. His temperature had been 39.1° C. (102.4° F.). His pulse rate had been 96 and respirations 26. He had had clubbed fingers. The pulse rate had been regular, the tension moderate and the vessel wall just palpable. The apex heart beat had been most prominent in the fourth intercostal space in the nipple line and had been visible over an area five centimetres in diameter. Palpation had revealed the presence of a systolic thrill. The heart dulness had extended from the third rib superiorly to a point 1.25 centimetres to the right of the sternum and ten centimetres to the left inferiorly. Auscultation had revealed a rough systolic murmur at the mitral area. This had been conducted into the axilla. The second sound at the mitral area had been clear and distinct. In the aortic area both sides had been clear and at the pulmonary area the second sound had been accentuated. A blowing systolic murmur had been audible at the base of the sternum over the tricuspid area. Examination of the lungs had failed to reveal any abnormal signs with the exception of a few scattered rhonchi. Examination of the nervous and urinary systems had failed to reveal any abnormalities. The tongue had been moist, but coated, and the teeth bad. Otherwise no abnormalities had been discovered in the alimentary system. Repeated examination of the sputum for tubercle bacilli had failed to reveal the presence of that organism. A blood culture had been made but this had proved to be sterile. A blood count had shown the red cells to number 3,200,000 per cubic millimetre. The leucocytes had numbered 9,300, the hæmoglobin value had been 70% and there had been no definite alteration in either the size of the shape of the red cells. The patient's serum had failed to yield a reaction to the Wassermann test. Gonococci had been isolated from a urethral discharge which had reappeared two days after his admission to hospital. The patient had not improved, but had gradually become weaker and more wasted. On July 31 he had complained of pain in the region of the right kidney, accompanied by frequency of micturition. Pus and blood had appeared in the urine. Petechial hæmorrhages had been noted on the forearms and on the medical aspects of the thighs. These had appeared in increasing numbers and at the time of demonstration had been present all over the body.

Gonococcal Arthritis.

A female patient, aged twenty-three years, had been admitted to hospital on June 13, 1922, complaining of pain in the left knee which had been present for five days. There had been no history of trauma and no other joint had been affected. She had been confined on May 24, 1922, at a period of seven months' gestation. She had had a purulent vaginal discharge and had had a temperature of 39.4° C. (103° F.). Examination on admission had shown the left knee to be swollen. The joint had contained fluid, but this had not been under tension. Aspiration of the joint had been performed and purulent fluid evacuated. Extension had been applied. A urethral smear had shown the presence of gonococci. Aspiration had been performed three times, but no fluid had been obtained on the last occasion. Anti-gonococcal serum had been given in doses of ten, twenty and thirty cubic centimetres at intervals of four days from June 22 to June 30. The temperature had become normal after extension had been applied for four weeks. After removal of the extension fever had recurred and the extension had been re-applied for another month. At the time of demonstration there was considerable peri-articular thickening and almost complete fibrous ankylosis of the joint.

A female patient, aged eighteen years, had been admitted to hospital on July 7 with pain and swelling of the right elbow joint. No other joints had been affected and the temperature had been 37.4° C. (99.4° F.). The patient had had rheumatic fever twelve months previously. Examination of the joint had failed to reveal the presence of any fluid. Examination of the heart had disclosed the presence of a systolic murmur audible in the aortic area. The condition had responded to the administration of salicylates and the temperature had become normal on July 22, with a subsidence of the swelling in the elbow joints. On July 31 fever had recurred, with considerable pain and increased swelling of the right elbow. The patient had refused to allow the elbow to be touched or moved. Though no history of gonococcal infection had been obtained, the patient's blood serum had responded to the complement deviation test for the gonococcus. This had been done at the pathological department of the Royal Prince Alfred Hospital. Anti-gonococcal serum in doses of ten, twenty and thirty cubic centimetres had been administered on four occasions between August 10 and August 26. At the time of demonstration the patient had less pain and there was a diminution of swelling and an increase of movement in the joint. The chart showed that the patient had become afebrile.

Erysipelas, Pneumonia, Meningitis.

A female patient, aged twenty-four years, had been admitted to hospital on May 19, 1922, with erysipelas of the nose and forehead. Her temperature had been 40° C. (104° F.). Sixty cubic centimetres of anti-streptococcal serum had been administered and this had been repeated three days later. Two days after admission pus had formed in the cellular tissues of the face and scalp. This had necessitated numerous incisions. On the tenth day the patient had developed pneumonia at the bases of both lungs. On the fourteenth day, while still delirious, a hemiplegia of the right side had occurred. On the thirtieth day she had begun to pass about four litres (140 ounces) of urine *per diem* and it had been noted that the chest was again free from pneumonic signs. On the fortieth day the cerebrospinal fluid had been found to contain pus, no organisms had been found and it had been sterile on culture. Lumbar puncture had been repeated on four occasions without the discovery of any organisms. On the fifty-fourth day the patient had had a clonic fit. During this fit the patient had bitten her tongue, she had clenched her fists and her head had been jerked sharply to the right. The patient had subsequently had two similar fits. At the time of demonstration the patient was passing from one to two litres (thirty-five to seventy ounces) of urine *per diem* and the chart still showed the presence of a hectic type of temperature.

Meningitis Following Mumps.

A male patient, aged six and a half years, had been admitted to hospital on August 25, 1922, with a diagnosis of meningitis following mumps. The patient had had a swelling in each parotid region five days previous to admission and had been in bed for two days. On August 23 he had become restless, had had severe headache and had been feverish. He had subsequently vomited and had become unconscious. This had been followed by convulsions

during the night, accompanied by frothing at the mouth and lying in a position of opisthotonos. Examination of the child had shown it to be unconscious. The temperature had been 39° C. (102.2° F.), the pulse rate 100 and the respiration rate 26. The head had been retracted, the eyes had been opened and the pupils, moderately dilated, had reacted to light. There had been no nystagmus. The jaw had been clenched and white froth had issued from the mouth. The abdomen had been rigid and the abdominal reflexes exaggerated. The knee and ankle jerks had been exaggerated and the Babinski phenomenon had been present on each side. There had been an absence of clonus. The patient had had incontinence of urine and fæces and no orchitis had been present. There had been a number of purpuric spots on the legs. Lumbar puncture had been performed and twenty-four cubic centimetres of faintly turbid fluid not under increased pressure had been evacuated. Ten cubic centimetres of anti-meningococcal serum had been given intrathecally and twenty cubic centimetres intramuscularly. Examination of the cerebro-spinal fluid had shown the presence of numerous lymphocytes and the absence of pus cells. Diplococci had been present in great numbers. Some of these had been stained and some had been decolorized by the Gram method. Cultures had proved to be sterile. Lumbar puncture had been repeated after an interval of twelve hours and twenty-two cubic centimetres of blood-stained fluid had been obtained. Twenty cubic centimetres of serum had been injected intrathecally and ten cubic centimetres into the muscles. Lumbar puncture had been repeated on August 26 and 27. On August 28 the child had become conscious and though he had occasionally been restless, the temperature had become normal. Since that time progress had been steady.

Transverse Myelitis.

A female patient, aged thirty-six years, had been admitted to hospital on July 10, 1922. The patient had become ill suddenly on May 29, 1922. Prior to this date she had been in good health. On the day of onset she had been compelled to sit down on account of feeling "the strength going out of her feet" whilst walking about. Eighteen hours subsequently she had developed complete paralysis from the waist downwards and had lost control of the bladder and rectum. There had been no pain. There had been no history of tuberculosis in the family and she had not been unduly exposed to cold. The patient had three children and had had no miscarriages. The menstrual history had been normal. Examination on admission had shown the patient to be a big woman, looking extremely well and in excellent spirits. The lower limbs had been flaccid and completely paralysed. Knee jerks and other reflexes had been absent on both sides. There had been complete anæsthesia from a line corresponding to about the tenth dorsal segment. There had been no hyperæsthesia. Lumbar puncture had been performed and the cerebro-spinal fluid had contained a little *débris* and had not yielded a reaction to the Wassermann test. On August 12 there had been some movement of the legs as a whole, though it had not been possible to distinguish the active muscles. There had been no further improvement in the patient's condition at the time of the meeting.

Traumatic Purulent Arthritis.

A male patient, aged forty-five years, had been admitted to hospital on July 23, 1922, with a history of having twisted his knee suddenly three days previously. No snapping sensation had been felt, but the knee had become swollen and painful. Examination had shown the knee to be swollen, tense, tender and red. The knee joint had been aspirated and the limb put on extension; the aspiration had been repeated on several occasions. Organisms had been found in the fluid on two occasions. These had been reported as being cocci decolorizing by the Gram method of staining. Several intracellular diplococci had been seen. The fluid had always been sterile on culture. On two occasions ten centimetres of a 2% solution of formalin in glycerine had been injected into the joint after aspiration. The patient's temperature had become normal and extension had been removed after five weeks. At the time of demonstration movement was returning, though some periarticular thickening still remained.

Malignant Pustule of Face.

Three patients suffering from malignant pustule of the face were shown. The histories of these patients were published in THE MEDICAL JOURNAL OF AUSTRALIA, September 30, 1922 (page 386).

Henoch's Purpura.

A male patient suffering from Henoch's purpura was shown. The history of this patient was given in THE MEDICAL JOURNAL OF AUSTRALIA, October 14, 1922 (page 446).

A MEETING of the New South Wales Branch of the British Medical Association was held at the B.M.A. Building, 30 to 34, Elizabeth Street, Sydney, on September 29, 1922, DR. T. W. LIPSCOMB, the President, in the chair.

Flies and Infection.

ACTING PROFESSOR LAUNCELOT HARRISON read a paper entitled "Flies in Relation to Infectious Disease" (see page 489).

DR. C. W. REID expressed his indebtedness to Professor Harrison for his excellent address. He had given them much food for thought and a variety of subjects for discussion. From the point of view of health preservation, it was essential to attack the fly in a systematic manner. The best time for making the attack was in the spring. It was necessary to remember that the stage of development from the deposition of eggs to the end of pupation was about ten days. If the attack were made on the eggs, the reduction of flies would be immense. Professor Harrison had spoken of the presence of *Stegomyia fasciata* and other varieties of this mosquito in Australia and its potential danger as a carrier of yellow fever. So far yellow fever had not been introduced into the Commonwealth. He was inclined to think that the risk was not as great as it might seem to be. In the older days of the sailing ship the mosquitoes were bred in the water tanks and casks on board and they might become infected at any stage during the voyage. Nowadays the infected mosquito would have to be carried all the way. It was known that the period of infectivity was only three days. Moreover, the wrigglers were easily killed. They had anophelines and stegomyia mosquitoes in Queensland and possibly in the north of New South Wales. Malaria had been known to occur in Gosford. It should further be remembered that approximately 97% of the first expeditionary force to Rabaul were infected with malaria.

The part played by the house fly in the distribution of disease was extremely interesting. Dr. Reid referred to the experiments carried out during the American-Spanish war. By sprinkling fæces with lime, they had been able to determine that flies attacked the fæces and then wandered over to food. There was no doubt concerning the danger of the fly in spreading enteric fever. At one time it had been held that small-pox was an air-borne disease. Now it was known that the infection was conveyed either by contact or through the medium of some movable object. It was possible that in certain conditions epithelioma of the face was conveyed from one patient to another by means of flies.

DR. ROBERT DICK thanked Professor Harrison for the very able manner in which he had brought forward the question of insects as carriers of disease. The dissemination of knowledge in this way was of the greatest value to the whole community. He was convinced that it was not the big things in life that really counted. No one concerned himself greatly about the dangers from ferocious animals; but every sensible man recognized the peril of insects. They feared spirochætes and cocci. Flies had been in existence before any of them had been born. They exercised an important part in the economy of Nature. Carcases and other organic material were reduced to harmless elemental substances by the instrumentality of insects. It was only in connexion with disease that insects exercised a harmful influence. In regard to mosquitoes, it would seem as if Australia possessed certain natural advantages that did not favour the propagation of some of the diseases with which Professor Harrison had dealt. Formerly vessels had put out from Rio de Janeiro so

heavily laden with yellow fever that they had been compelled to return to port to obtain new crews. Yet those ships that had arrived in Australia from this danger zone, had not sufficed to introduced yellow fever into the Commonwealth. The same appeared to be true in regard to malaria. Anopheline mosquitoes were quite prevalent in the coastal and western districts and on the highlands of the State. On the other hand, it was rare to get primary malaria. Certain conditions must exist before an outbreak could occur. The mosquitoes must be present in sufficient numbers. The amount of infection must also be considerable. In regard to filariasis, he wished to point out that not every exposed person acquired the disease. It was not uncommon for one member only of a large family to be infected. A brother or sister sleeping in the same bed as the infected person, escaped.

Dr. Dick regarded the house fly as a very important insect in regard to disease. It was so intimately associated with man and with animals, both of which furnished them with food and suitable breeding grounds. There was no doubt that excreta provided the principal breeding places for flies. He held that horses should be excluded from the vicinity of men's dwellings. It had been hoped that with the introduction of motor traffic, the number of horses in the cities would be materially lessened. During the past ten years the diminution in the number of horses amounted to only 5% in Sydney. Horses in densely populated districts were potential dangers. Then there was the important question of the disposal of human excreta. The only satisfactory method was by water-borne sewerage systems. In the metropolitan area, notwithstanding the fact that they had facilities for this system, there were thousands of houses unprovided with water closets. Dr. Dick maintained that there was an urgent need for the immediate institution of water-borne sewerage systems in all cities and large towns. He recognized that this meant the expenditure of much money. It was better to pay for these facilities than to pay the doctor's or the undertaker's bills. Garbage, too, required proper methods of handling. The best of all was incineration. It was illusory to trust to deposition of garbage at a distance from human dwellings. Flies could travel long distances. Until recently it had been thought that the range of the flight of a fly was but a couple of hundred metres. Flies had been traced as far as twenty-one kilometres (about thirteen miles). Night soil trenches and tips were providing hot-beds for a continuous supply of house flies. If they cleaned up the cities and towns by proper sewerage systems, by the incineration of garbage and by the removal of manure heaps, they would still have some flies for the individual to destroy. They had recently shown that it was impossible to kill all the rats in a city. How much more impossible would it be to kill all the flies? The fecundity of flies was proverbial and the task of destruction stupendous. The individual citizen would have to contribute to the general campaign.

DR. HARVEY SUTTON, O.B.E., paid a tribute to Professor Harrison. He had been specially interested in listening to his account of his doings in Mesopotamia. It was like fighting the battles of Sinai and Palestine over again. He assured Professor Harrison that he had no reason for diffidence in addressing a gathering of medical practitioners. The health work in the tropics represented a triumph for the entomologist. This had been proved up to the hilt during the war period. The military had occupied areas, such as the Jordan Valley, that must have proved death-traps without their aid. In the eastern theatres of the war it had been recognized that the incidence of the fly had corresponded to the incidence of diarrhœal diseases. Further elimination of the fly had reduced these diseases to a minimum. More and more knowledge was required by the public concerning insects in Australia. They should not forget that they were living in a sub-tropical country. The greater part of their knowledge concerning disease had been taught with reference to temperate climates. In cool climates, for example, burial of excreta was probably quite sound. In Australia, owing to fly breeding, it was a failure. They should also remember that the experience gained during the war was not entirely translatable to the conditions in Australia. At the war they had had complete control over all refuse and had been able to incinerate all manure and other filth. In Australia the agriculturist would not burn horse manure. It was possible, however, by pit packing and the use of borax to keep manure safely. This method had been advocated by the United States Board of Agriculture. In attacking the fly it was necessary to recognize that they could not deal with it as an air force. On the other hand, they could deal with it as infantry in the breeding stage. They had learned from Austen, the entomologist, that no system of sanitation was acceptable that permitted the contact of the fly with excreta or other infective material. These and other points in connexion with the destruction of flies should be made the subject of education.

Research into local conditions was needed and they looked to skilled entomologists like Professor Harrison to carry out this research. It would seem that the common bush or "out of door" fly was scarcely a danger. The house fly was of great importance because of its preference for man's dwellings, his food and his refuse. Experience pointed to the possibility of changes in the life history of insects.

Before the year 1909 the blow fly had not been regarded as a pest among sheep. Somehow or another this fly had acquired a taste for smelly wool. Further research was required to explain why this fly had become a pest. He approved of the criticisms that Professor Harrison had made concerning the medical profession. Doctors too often revealed an indifference concerning matters connected with sanitation and methods of prevention of disease. By the proper control of septic tanks, by the use of manure pit systems and by the adoption of other means of eliminating flies it might be possible to cope with the pest in the country. They were beginning an educational system in the schools. Dr. Sutton invited Professor Harrison to assist them in disseminating useful knowledge in regard to the problem of insects as carriers of disease. In the nature study text-book in use there were admirable descriptions of the life history of the fly, but not one word concerning the best way to exterminate it. Professor Harrison had referred to "bung eye." It had been shown that this condition was, as a rule, not the result of the bite of an insect, but was a bacterial infection carried by non-biting flies. By excluding the common towel, by the general use of fly veils and by protecting sore eyes with fly-proof goggles, it was possible to prevent the spread of this condition and of trachoma.

Dr. Sutton agreed with Dr. Dick in regard to the importance of enlisting the cooperation of the individual in the first against the fly. He felt sure that the individual could control the pest without much expenditure of money, provided that he brought some intelligence into operation. During the war men with malaria had been made to understand that they were potentially reservoirs of infection. The result was that they had taken steps to avoid exposing others to risk of infection. Dr. Blackburn's work in combating malaria among the troops by effective treatment was an admirable example of what could be achieved. In conclusion, Dr. Harvey Sutton thought that the danger of malaria was perhaps not very great in Australia, but no guarantee existed that it would remain so. Very little was known about dengue in the early days, yet in more recent years a pandemic had occurred and a mosquito had been incriminated as carrier.

DR. J. S. PURDY, D.S.O., said that his attention had first been directed to the relationship of flies to the spread of enteric fever during the South African war, when he had noted that during the first nine months' trekking of the Australian and New Zealand troops with Plumer's Force, when they seldom camped two consecutive days in one camp, they had practically no enteric fever. After being forced on account of a reverse at Onverwacht in January, 1902, to go into a standing camp at Wakkerstrom for a fortnight, he had within another fortnight to take a convoy of over a hundred men with enteric fever into Charlestown Hospital.

During the time in camp it had been stated that if the bugle had been the signal for mess, the flies which swarmed in the latrines evidently knew the call.

Later, whilst in the Egyptian Quarantine Service, he had cooperated with Ross in the successful campaign for the extermination of mosquitoes at Port Said.

He also spoke of his experience at El Tor, Sinai, when

in 1906 there were one nundred and ten deaths from bacillary dysentery among the Mecca pilgrims in six weeks. On pointing out to the head of the Service, Armand Ruffer, the possibility of the spread of infection by flies, which were in myriads around the dead and the dying, little attention had been paid thereto. It had been gratifying on returning to Egypt with the Australian Imperial Force in 1914 to find there was no one more keen on this subject than Armand Ruffer.

In Egypt during the recent war, previous to the advent of the entomologists, the most success in combating the fly in camps had been by the use of crude petroleum in latrines. Austen had helped in the introduction of deep trench latrines, while Graham had been successful with incinerators, which dealt with all horse manure as well as human excreta.

In civil life he considered the substitution of mechanical for horse transport as one of the chief means of mitigating the fly pest. The discovery of oil in Australia, by cheapening petrol, would help to solve the problem as the difficulty of dealing with horse manure was considerable, owing to its general use in gardens. Borax had been advocated as an application for manure, but it was expensive, whilst arsenite of soda, although effective, was dangerous.

The screening of houses, the trapping of flies and the protection of food and incineration of garbage were measures to be advocated and a good deal could be accomplished by a systematic campaign of education.

Dr. C. E. Corlette referred to the problem of the undecomposed horse-dung carter to gardens under the idea that it was manure. He claimed that in the absence of proper nitrification by bacteria it was very inferior as a manure and that chemeical manures should be much better. He wanted to know why people should be permitted to make themselves a nuisance to their neighbours.

Dr. T. W. Lipscomb thanked Professor Harrison for his admirable address. He was convinced that it would prove of great value to the profession. In regard to the storing of manure, he thought that the best method was that of the deep manure pit. A layer of black soil was strewn over the surface of the manure and this was left undisturbed for twelve months. In this time the manure could ripen for use and the flies could not use the manure as a breeding ground.

In his reply, Professor Launcelot Harrison expressed gratification at the way in which his address had been received. He had been glad that others had amplified what he had said. There was much practical information that could be put before the public. He was pleased that he had the support of the public health authorities. He claimed that by observation it was possible to learn how to deal with these pests. They embodied actual and potential dangers. He had not intended to criticize the medical profession, but merely to point out that their interest should be awakened in order that those who took up this matter, should have the weight of the whole of the profession behind them.

NOMINATIONS AND ELECTIONS.

The undermentioned have been elected members of the New South Wales Branch of the British Medical Association:

Cunningham, Anthony Benedict, M.B., Ch.M., 1921 (Univ. Sydney), 48, Alexandra Street, Manly.

Kerr, William Arthur, M.B., Ch.M., 1922 (Univ. Sydney), Morton Street, Wollstonecraft.

Kinna, Alwyn Leslie, M.B., 1922 (Univ. Sydney), Molong.

McLean, Ivan Alexander, M.B., Mast. Surg., 1921 (Univ. Sydney), Sydney Hospital.

Thompson, George Sydney, M.B., Ch.M., 1922 (Univ. Sydney), Royal Prince Alfred Hospital, Sydney.

Post-Graduate Work.

NOVEMBER COURSE IN MELBOURNE.

The Melbourne Permanent Committee for Post-Graduate Work is issuing the following syllabus of the next course, which will be held during the fortnight November 13 to 15, 1922.

The fee for the course is three guineas. The Committee ask those intending to join to forward their names and, in the case of members visiting Melbourne, their addresses in Melbourne during the course not later than October 31, 1922, to Dr. J. H. Anderson, Department of Anatomy, Medical School, University of Melbourne. The fee should be paid on entry. Entries made later than October 31 will be recognized. Further information will be supplied by Dr. Anderson to those requiring it.

Monday, November 13, 1922.

11.15 a.m. to 1 p.m.: Dr. B. Kilvington: Surgical Cases, including "Exophthalmic Goitre," at the Melbourne Hospital.
Dr. F. B. Lawton: Medical Cases at the Melbourne Hospital.

2.15 p.m. to 3.30 p.m.: Dr. W. F. Orr and Dr. P. Webster: "Clinical Methods with Illustrative Cases," at the Eye and Ear Hospital.

Tuesday, November 14, 1922.

9.30 a.m. to 11 a.m.: Dr. H. B. Devine: Slected Surgical Cases, at Saint Vincent's Hospital.
Dr. L. S. Latham: Medical Cases in the Wards, at Saint Vincent's Hospital.

11.15 a.m. to 1 p.m.: Dr. A. N. McArthur: "Uterine Fibroids, Fibro-Myomata," at Saint Vincent's Hospital.
Dr. C. Gordon Shaw: Surgical Cases, at Saint Vincent's Hospital.

2.15 p.m. to 3.30 p.m.: Dr. Hume Turnbull: Medical Cases, at the Children's Hospital.

3.30 p.m. to 5 p.m.: Dr. C. W. B. Littlejohn: "Chronic Joint Affections in Children," at the Children's Hospital.

Wednesday, November 15, 1922.

9.30 a.m. to 11 a.m.: Dr. R. H. Morrison: Clinical Lecture and Demonstration of Cases, at the Women's Hospital.

11.15 a.m. to 1 p.m.: Dr. R. N. Wawn and Dr. R. Fowler: Ante-Natal Clinic, at the Women's Hospital.

2.15 p.m. to 3.30 p.m.: Dr. L. J. C. Mitchell: "Eye Work in General Practice," with demonstration of cases, at the Melbourne Hospital.
Dr. Mark Gardner: "Squint," at the Melbourne Hospital.

8 p.m.: Conjoined Meeting of the Victorian Branch of the British Medical Association and the Melbourne Pædiatric Society, at the Children's Hospital.

Thursday, November 16, 1922.

9.30 a.m. to 11 a.m.: Dr. D. Murray Morton: Surgical Cases in the Wards, at Saint Vincent's Hospital.
Dr. A. E. Rowden White: Demonstration of Clinical Cases, at Saint Vincent's Hospital.

11.15 a.m. to 1 p.m.: Dr. J. Forbes Robertson: "The Management of Head Injuries" and Surgical Cases in the Wards, at Saint Vincent's Hospital.

2.15 p.m. to 3.30 p.m.: Dr. S. W. Ferguson: "Infantile Diarrhœa," at the Children's Hospital.

3.30 p.m. to 5 p.m.: Mr. W. G. D. Upjohn: "Bow Legs and Allied Conditions," at the Children's Hospital.

Friday, November 17, 1922.

9.30 a.m. to 11 a.m.: Dr. S. V. Sewell: "The Diagnosis and Management of Early Tuberculosis," at the Melbourne Hospital.
Mr. Alan Hailes: "The Diagnosis and Treatment of Acute Intestinal Obstruction," at the Melbourne Hospital.

11.15 a.m. to 1 p.m.: DR. HUME TURNBULL: Medical Cases in the Out-Patient Department, at the Melbourne Hospital.
MR. T. E. VICTOR HURLEY: Surgical Cases in the Out-Patient Department, at the Melbourne Hospital.
2.15 p.m. to 3.30 p.m.: DR. H. D. STEPHENS: "Acute Surgical Conditions in Children," at the Children's Hospital.
3.30 p.m. to 5 p.m.: DR. REGINALD WEBSTER: Demonstration of Pathological Specimens of Interest, at the Children's Hospital.
8 p.m.: DR. ARTHUR E. MORRIS: "Gonorrhœa: A Standard of Cure; Preventive Treatment," at the Melbourne Hospital.
DR. K. A. MCLEAN: "Gonorrhœa: A Standard of Cure," at the Melbourne Hospital.

Saturday, November 18, 1922.

9.30 a.m. to 11 a.m.: MR. H. R. DEW: Clinical Cases (with Special Reference to Bone and Joint Conditions), in the Out-Patient Department at the Melbourne Hospital.
DR. S. W. PATTERSON: Medical Cases, in the Out-Patient Department at the Melbourne Hospital.

Monday, November 20, 1922.

9.30 a.m. to 11 a.m.: DR. J. F. MACKEDDIE: "Renal Efficiency Tests," at the Alfred Hospital.
11.15 a.m. to 1 p.m.: MR. R. C. BROWN: "The Management of Difficult Appendix and Gall Bladder Cases," at the Alfred Hospital.
DR. J. P. MAJOR: Medical Cases, especially "Exophthalmic Goitre," at the Alfred Hospital.
2.15 p.m. to 3.30 p.m.: DR. J. H. NATTRASS: Clinical Lecture and Demonstration of Cases, at the Women's Hospital.
3.30 p.m. to 5 p.m.: Demonstration of Out-Patients, at the Women's Hospital.
8 p.m.: DR. J. KENNEDY: "Venereal Disease"; Demonstration of Cases and Method of Treatment, at the Alfred Hospital.

Tuesday, November 21, 1922.

9.30 a.m. to 11 a.m.: DR. R. H. STRONG: "Cases Illustrating Arthritis in Various Diseases," at the Melbourne Hospital.
MR. H. ALAN S. NEWTON: Surgical Cases in the Out-Patient Department, at the Melbourne Hospital.
11.15 a.m. to 1 p.m.: MR. T. E. L. LAMBERT: Surgical Cases, at the Melbourne Hospital.
DR. R. P. MCMEEKIN: Medical Cases, at the Melbourne Hospital.
2.15 p.m. to 3.30 p.m.: DR. R. R. WETTENHALL: Dermatological Cases, at the Melbourne Hospital.

Wednesday, November 22, 1922.

9.30 a.m. to 11 a.m.: DR. R. WAWN: Clinical Lecture, at the Women's Hospital.
11.15 a.m. to 1 p.m.: DR. A. M. WILSON AND DR. R. W. CHAMBERS: Ante-Natal Clinic, at the Women's Hospital.
2.15 p.m. to 3.30 p.m.: DR. B. MILNE SUTHERLAND: Clinical Lecture and Demonstration of Cases, at the Women's Hospital.
3.30 p.m. to 5 p.m.: Demonstration of Out-Patients, at the Women's Hospital.

Thursday, November 23, 1922.

9.30 a.m. to 11 a.m.: DR. W. W. JOHNSTON: Demonstration on the Methods of Testing Blood Donors and Blood Transfusion, at the Melbourne Hospital.
MR. W. G. D. UPJOHN: Surgical Cases in the Out-Patient Department, at the Melbourne Hospital.
11.15 a.m. to 1 p.m.: DR. K. HILLER: Medical Cases, at the Melbourne Hospital.
MR. B. T. ZWAR: "Surgical Conditions of the Tongue, Lips and Floor of the Mouth," at the Melbourne Hospital.
2.15 p.m. to 3.30 p.m.: DR. F. V. SCHOLES: Demonstration of Cases, at the Infectious Diseases Hospital, Fairfield.

Friday, November 24, 1922.

9.30 a.m. to 11 a.m.: MR. B. QUICK: Selected Surgical Cases, at the Alfred Hospital.
DR. M. D. SILBERBERG: "Treatment in Disorders of the Heart and Circulation," at the Alfred Hospital.
11.15 a.m. to 1 p.m.: MR. FAY MACLURE: Local Anæsthesia, at the Alfred Hospital.
DR. H. LAURIE: "Cases Illustrating Intravenous Protein Therapy in Rheumatic Arthritis," at the Alfred Hospital.
2.15 p.m. to 3.30 p.m.: DR. R. M. DOWNES: "Tuberculous Hip," at the Children's Hospital.
3.30 p.m. to 5 p.m: DR. R. L. FORSYTH: "Weaning," at the Children's Hospital.

Saturday, November 25, 1922.

9.30 a.m. to 11 a.m.: Surgical and Pathological Anatomy, at the Walter and Eliza Hall Institute.

Obituary.

REGINALD BOWMAN.

A SHORT time ago the medical profession in and around Sydney was shocked at the news of the death of Reginald Bowman, who had for many years been known and respcted by all practitioners throughout the State of New South Wales.

Reginald Bowman was born at Archerfield, Singleton, New South Wales, in 1861. He was a pupil at the Sydney Grammar School and even in the early days took his lessons, his sports and his obligations to his *alma mater* seriously. He helped in every way within his power to maintain the prestige of his school. In later life he never forgot the place where his happy school days were spent and remained a staunch supporter of "Grammar." At the age of eighteen he went to Scotland and entered the medical school at the University of Edinburgh. Here, again, he achieved success and became a general favourite. In 1885 he took his degrees in medicine and surgery and in the same year he passed the examination for the membership of the Royal College of Surgeons of England.

In the following year he returned to Australia and immediately turned his attention to practice. He succeeded the late Dr. Curtin at Granville. For two or three years he developed this practice and then moved to Parramatta. His ability as a practitioner and his popularity with all sorts and conditions of men rendered his task of building up a substantial practice an easy one. In the course of time he was appointed medical officer at the local hospital and later he attained the senior position. He was also appointed Government Medical Officer for the district.

His admirable qualities and his attractive personality were recognized far and wide in the medical profession in the State. A large gathering at the graveside attested to the high regard in which he was held. Many expressions of sympathy have been received by his widow, his son, Dr. R. McDougall Bowman, and the other members of his family.

SAMUEL HAMMOND.

THE death of Samuel Hammond at the age of eighty-six occurred on August 30, 1922, at Toowong, Queensland. He came of a long-lived family, his father, a medical practitioner, having lived to the age of ninety-three. Samuel Hammond was born at Edmonton, near London. He was educated at Sherbourne. He studied medicine at the London Hospital and obtained the qualifications of M.R.C.S., L.S.A. in 1858 and of L.R.C.P., Edinburgh, in 1860.

At first he practised in Surrey. In 1883 he travelled to New Zealand on account of ill-health. He took a position at the Wellington General Hospital and later started practice at Timaru. In 1886 he was placed in charge of a hospital boat in Sydney Harbour during an outbreak of variola. He contracted a mild attack while on duty.

He made a short stay in Cairns and then selected Toowong, in the neighbourhood of Brisbane, as a suitable place in which to practise. He remained there for thirty years. He was a man of quiet, retiring disposition. He loved books and was an omnivorous reader on divers subjects. He was a prominent Free Mason and took an active part in masonic affairs up to the time of his death. He was twice married. He is survived by a widow, a son and a daughter.

Proceedings of the Australian Medical Boards.

VICTORIA.

THE undermentioned have been registered under the provisions of the *Medical Act, 1915*, as duly qualified medical practitioners:

ALPERS, PHILIP JACOB, M.B., B.S., 1922 (Univ. Melbourne), "The Manse," Mannim, South Australia.

GRANT, FRANK JOHN AUDAS, M.B., B.S., 1922 (Univ. Melbourne), "K7," High Street, Windsor.

HEWER, GEORGE FREDERICK, M.B., M.S., 1919 (Univ. Sydney), c.o. W. Ramsay, 80, Swanston Street, Melbourne.

WEBB, JOHN NEWTON, M.B., B.S., 1917 (Univ. Adelaide); D.P.H., 1920 (Lond.), "Edgarleigh," corner Nepean Road and Cochrane Street, Elsternwick.

Additional Qualification Registered.

LEE, ALAN EDWARD, M.D., 1921 (Univ. Melbourne).

QUEENSLAND.

THE undermentioned have been registered as duly qualified medical practitioners under the provisions of the *Medical Act, 1867*:

BYRNE, JOHN EDWARD, M.B., B.S., 1922 (Univ. Melbourne), Lady Bowen Hospital.

MASON, ALFRED ERIC, M.B., B.S., 1922 (Univ. Melbourne), Brisbane.

PHILP, DORIS MARGARET, M.B., Ch.M., 1922 (Univ. Sydney), Toowong.

Additional Qualification.

GREEN, HARRY, Ch.M., 1922 (Univ. Sydney).

Books Received.

THE DIAGNOSTICS AND TREATMENT OF TROPICAL DISEASES, by E. R. Stitt, A.B., Ph.G., M.D., Sc.D., LL.D.; Fourth Edition, Revised; 1922. Philadelphia: P. Blakiston's Son & Company; Post 8vo., pp. xiii. + 622, with 159 illustrations.

Medical Appointments.

DR. DAVID KERR has been elected to the position of Government Medical Officer at Adelong, New South Wales.

Medical Appointments Vacant, etc.

FOR announcements of medical appointments vacant, assistants, *locum tententes* sought, etc., see "Advertiser," page xviii..

AUSTIN HOSPITAL, HEIDELBERG: Honorary Physicians and Honorary Surgeons.

CROYDON DISTRICT HOSPITAL, NORTH QUEENSLAND: Medical Officer.

RICHMOND DISTRICT HOSPITAL, NORTH QUEENSLAND: Medical Officer.

Medical Appointments: Important Notice.

MEDICAL practitioners are requested not to apply for any appointment referred to in the following table, without having first communicated with the Honorary Secretary of the Branch named in the first column, or with the Medical Secretary of the British Medical Association, 429, Strand, London, W.C.

BRANCH.	APPOINTMENTS.
NEW SOUTH WALES: Honorary Secretary, 30 - 34, Elizabeth Street, Sydney	Australian Natives' Association Ashfield and District Friendly Societies' Dispensary Balmain United Friendly Societies' Dispensary Friendly Societies Lodges at Casino Leichhardt and Petersham Dispensary Manchester Unity Oddfellows' Medical Institute, Elizabeth Street, Sydney Marrickville United Friendly Societies' Dispensary North Sydney United Friendly Societies People's Prudential Benefit Society Phœnix Mutual Provident Society
VICTORIA: Honorary Secretary, Medical Society Hall, East Melbourne	All Institutes or Medical Dispensaries Australian Prudential Association Proprietary, Limited Manchester Unity Independent Order of Oddfellows Mutual National Provident Club National Provident Association
QUEENSLAND: Honorary Secretary, B.M.A. Building, Adelaide Street, Brisbane	Brisbane United Friendly Society Institute Stannary Hills Hospital
SOUTH AUSTRALIA: Honorary Secretary, 12, North Terrace, Adelaide	Contract Practice Appointments at Renmark Contract Practice Appointments in South Australia
WESTERN AUSTRALIA: Honorary Secretary, Saint George's Terrace, Perth	All Contract Practice Appointments in Western Australia
NEW ZEALAND (WELLINGTON DIVISION): Honorary Secretary, Wellington	Friendly Society Lodges, Wellington, New Zealand

Diary for the Month.

OCT. 30.—Victorian Branch, B.M.A.: Council Nomination Paper Issued.
Nov. 3.—Queensland Branch, B.M.A.: Branch.
Nov. 8.—Western Australian Branch, B.M.A.: Council.
Nov. 8.—Melbourne Pædiatric Society.
Nov. 9.—Victorian Branch, B.M.A.: Council; Nomination of London Representative.
Nov. 10.—New South Wales Branch, B.M.A.: Clinical Meeting.
Nov. 10.—Queensland Branch, B.M.A.: Council.
Nov. 10.—South Australian Branch, B.M.A.: Council.
Nov. 14.—New South Wales Branch, B.M.A.: Ethics Committee.
Nov. 15.—Western Australian Branch, B.M.A.: Branch.
Nov. 16.—North-Eastern Medical Association, New South Wales.
Nov. 15.—Victorian Branch, B.M.A.: Branch.
Nov. 21.—New South Wales Branch, B.M.A.: Executive and Finance Committee.
Nov. 21.—Illawarra Suburbs Medical Association, New South Wales: Annual Meeting.
Nov. 23.—Brisbane Hospital for Sick Children: Clinical Meeting.
Nov. 24.—New South Wales Branch, B.M.A.: Branch.
Nov. 24.—Queensland Branch, B.M.A.: Council.

Editorial Notices.

MANUSCRIPTS forwarded to the office of this journal cannot under any circumstances be returned. Original articles forwarded for publication are understood to be offered to THE MEDICAL JOURNAL OF AUSTRALIA alone, unless the contrary be stated.

All communications should be addressed to "The Editor," THE MEDICAL JOURNAL OF AUSTRALIA, B.M.A. Building, 30-34, Elizabeth Street, Sydney. (Telephone: B. 4635.)

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